BIOLOGICAL EVALUATION / BIOLOGICAL ASSESSMENT
TERRESTRIAL WILDLIFE

SAGEHEN PROJECT

TRUCKEE RANGER DISTRICT
TAHOE NATIONAL FOREST

MAY 2, 2013

PREPARED BY: /S/ *TINA MARK* **DATE** **MAY 2, 2013**

TINA MARK, FOREST BIOLOGIST
JOURNEY LEVEL WILDLIFE BIOLOGIST

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

DATE: February 20, 2013

PROJECT NAME: Sagehen Project

SCOPE OF AREA AFFECTED:
Most of the proposed Sagehen Project is located within the Sagehen Experimental Forest, which is under the management and direction of a partnership between the Forest Service's Pacific Southwest Research Station (PSW) and the Tahoe National Forest (TNF), in strong collaboration with the University of California (UC) at Berkeley, which manages the Sagehen Creek Field Station in the center of the Basin under a Special Use Authorization. Experimental forests and ranges are intended to be living laboratories where Forest Service scientists and collaborators conduct research and demonstrate research results through experimental approaches that examine various land management and conservation strategies. These lands offer one of the few opportunities to conduct manipulative,

innovative research that will produce scientific knowledge required for the stewardship of the Nation's natural resources.

The Sagehen Project proposes to utilize a suite of integrated silvicultural and fire/fuels prescriptions on approximately 2,500 acres of coniferous forests to reduce hazardous fuel loadings and modify landscape-scale wildland fire behavior; maintain and enhance habitat for the marten and other wildlife species associated with late seral forest habitat; create heterogeneous forest stand conditions that would be expected to develop under an active fire regime; enhance the ecological role of fire; and restore declining aspen stands within unit boundaries. These activities are proposed to occur within a 29,467-acre wildlife analysis area. No acres within California spotted owl PACs, or SOHAs are proposed for treatment. See the proposed action for a more detailed description of the project area.

STATUS OF CONSULTATION WITH THE USFWS: The USFWS is contacted every 90 days to obtain a current list of threatened, endangered, and candidate species that may be affected by activities in Tahoe National Forest. This list is maintained at 50 CFR 17.11. The most recent list was updated September 18, 2011and reported November 8, 2012, and can be accessed at the following location: http://www.fws.gov/sacramento/es_species/Lists/es_species_lists_NF-action-page.cfm

Consultation with the United States Fish and Wildlife Service (USFWS) is not needed for this project. No Federally listed threatened, endangered or candidate wildlife species would be affected by the proposed action or alternatives (refer to "Existing Environment" Section for rationale that led to a "no effect" determination.

PREPARED BY: Tina Mark, Forest Biologist, (530) 478-6240, tmark@fs.fed.us

Table 1. Executive summary of species analyzed in this Biological Evaluation / Biological Assessment.

SPECIES	SPECIES STATUS[1]	PRESENT IN PROJECT AREA: Habitat &/or detections	MANAGEMENT REQUIREMENTS, STANDARDS, GUIDELINES, SPECIES SPECIFIC PROJECT DESIGN STANDARDS	EFFECTS DETERMINATION	RECOMMENDED MITIGATION FOR NO EFFECT
TERRESTRIAL SPECIES					
Valley elderberry longhorn beetle	T	N	None	No effect	NA
Bald eagle	S		**Nests:** If large stick nests are observed in or near trees that are designated for removal or in down logs, the occurrence and location should be reported to the wildlife biologist to determine the need for further review. See standard mitigations measures below.	May affect individuals, not likely to lead to a trend toward federally listing or loss of viability within the planning area	None
California spotted owl	S	Y	A LOP will be in effect from March 1 to August 15 for Units 156 and 163. This LOP may be modified by the wildlife biologist if surveys determine nesting will not be affected within ¼ mile of the proposed activities.	May affect individuals, not likely to lead to a trend toward federally listing or loss of viability within the planning area	None
Great gray owl	S	N	See standard mitigations measures below.	May affect individuals, not likely to lead to a trend toward federally listing or loss of viability within the planning area	None
Northern goshawk	S	Y	**Northern Goshawk Limited Operating Periods:** A LOP will be in effect from February 15 to September 15 for Units 33, 34, 35, 36, 38, 39, and 163. This LOP may be modified by the wildlife biologist if surveys determine nesting will not be affected within ¼ mile of the proposed activities. **Nests:** If large stick	May affect individuals, not likely to lead to a trend toward federally listing or loss of viability within the planning area	None

			nests are observed in or near trees that are designated for removal or in down logs, the occurrence and location should be reported to the wildlife biologist to determine the need for further review.		
Willow flycatcher	S	Y		May affect individuals, not likely to lead to a trend toward federally listing or loss of viability within the planning area	None
Greater sandhill crane	S	N	None	No effect	None
Pacific fisher	S, C	N	None	No effect	None
Pacific marten	S	Y	**Denning Structures:** If signs of active denning are observed in or near trees that are designated for removal or in down logs, the occurrence and location should be reported to the wildlife biologist to determine the need for further review.	May affect individuals, not likely to lead to a trend toward federally listing or loss of viability within the planning area	None
Sierra Nevada red fox	S	N	None	No effect	None
California wolverine	S, proposed for listing as threatened	Y	**Denning Structures:** If signs of active denning are observed in or near trees that are designated for removal or in down logs, the occurrence and location should be reported to the wildlife biologist to determine the need for further review.	May affect individuals, not likely to lead to a trend toward federally listing or loss of viability within the planning area	None
Pallid bat	S	Y	None	No effect	None
Townsend's big-eared bat	S	N	None	No effect	None
Western red bat	S	N	None	No effect	None

[1]Key: E = USFWS Endangered, T = USFWS Threatened, C = USFWS Candidate, S = USFS R5 Sensitive

In addition to the species specific standard mitigations measures, the following shall apply to all proposed treatment units for all applicable wildlife species addressed in this document:

30 inch dbh Trees: Avoid the felling of trees 30 inches dbh or greater during the implementation of temporary roads, skid trails and landings, to maintain large tree wildlife habitat. If this is not possible, the wildlife biologist would be consulted.

Snag Retention: Large snags (greater than 15 inches dbh) would be retained within all subunits, regardless of emphasis area. Where currently available within emphasis area 1, 2 and 5 subunits, some decadent firs with declining crown characteristics would be retained for future snag recruitment. Where existing snag levels are low, particularly within the plantations, silvicultural prescriptions retain all snags greater than three inches dbh.

Underburn and Snags: Hand-constructed fire lines would be placed around large snags before applying low intensity surface fire prescriptions. Each subunit's low intensity surface fire prescription (available in the project record) specifies the numbers of snags to be lined, based on existing numbers of large snags within the subunit. In emphasis area 1 and 2 subunits proposed for underburning, between 10 and 18 large snags per acre would be lined while in emphasis area 4, 5, 6, and 7 subunits, between 2 and 10 large snags per acre would be lined.

Pile burn and Snags: In treatment units where hand or grapple piling of fuels would be conducted, piles would be located a sufficient distance from large snags (greater than 15 inches dbh) to ensure the snags did not ignite during pile burning operations.

Down Woody Material: In all subunits, regardless of emphasis area, large down logs (larger than 15 inches diameter and ten feet long) would be retained during implementation of silvicultural treatments (mechanical thinning or mastication). Crushing of large down logs with machinery would be avoided.

Underburn and Woody Material: In units proposed for application of low intensity surface fire following silvicultural treatments, the largest down logs per acre would be lined to protect them during underburning operations. In emphasis area 1 and 2 subunits, line 15 to 20 large down logs per acre prior to underburning. In emphasis area 4, 5, 6, and 7 subunits, line 3-7 large down logs per acre, with the exception of subunits 163-5, 163-7, and 213-4. In these subunits, approximately 15 to 20 large logs per acre would be lined prior to application of low intensity surface fire. In treatment units proposed for surface fire prescriptions, approximately 30 percent of each unit's area would not be underburned. Small woody material would be retained in these unburned areas of the treatment units

Pile Burn and Woody Material: In treatment units proposed for grapple or hand piling, piles would be located a sufficient distance from large down logs to ensure the logs did not ignite during pile burning operations. In addition, piling would not be conducted on approximately 30 percent of the unit, allowing for retention of small down woody material.

II. INTRODUCTION

The purpose of this Biological Evaluation/Biological Assessment is to document analysis of the potential effects of the Sagehen Project on the following bird, mammal, amphibian, reptile, invertebrate and fish species and their habitats:

Table 2. Summary of species analyzed in this Biological Evaluation / Biological Assessment and their respective USFWS and USFS R5 (listed for Tahoe National Forest) status.

TERRESTRIAL SPECIES	
Valley elderberry longhorn beetle, *Desmocerus californicus dimorphus*	USFWS Threatened
Bald eagle, *Haliaeetus leucocephalus*	USFS R5 Sensitive (TNF)
California spotted owl, *Strix occidentalis occidentalis*	USFS R5 Sensitive (TNF)
Great gray owl, *Strix nebulosa*	USFS R5 Sensitive (TNF)
Northern goshawk, *Accipter gentilis*	USFS R5 Sensitive (TNF)
Willow flycatcher, *Empidonax trailii* subspecies *brewsteri* on the west slope of the Sierran Crest and subspecies *adastus* on the east slope	USFS R5 Sensitive (TNF)
Greater sandhill crane, *Grus canadensis tabida*	USFS R5 Sensitive (TNF)
Pacific fisher, *Martes pennanti*	USFS R5 Sensitive (TNF) USFWS Candidate
Pacific Marten, *Martes americana*	USFS R5 Sensitive (TNF)
Sierra Nevada red fox, *Vulpes vulpes necator*	USFS R5 Sensitive (TNF)
California wolverine, *Gulo gulo luteus*	USFS R5 Sensitive (TNF) USFWS Candidate
Pallid bat, Antrozous pallidus	USFS R5 Sensitive (TNF)
Townsend's big-eared bat, *Corynorhinus townsendii*	USFS R5 Sensitive (TNF)
Western red bat, *Lasiurus blossevillii*	USFS R5 Sensitive (TNF)

The above list includes United States Department of Interior Fish and Wildlife Service (USFWS) threatened, endangered, candidate, and proposed species maintained at 50 CFR 17.11 (updated September 18, 2011and reported November 8, 2012), and United States Department of Agriculture Forest Service Region 5 Forester's (USFS R5) Sensitive Species, listed for Tahoe National Forest (Updated as of June 8, 1998, Appended March 6, 2001, May 7, 2003, April 21, 2004, March 3, 2005, October 15, 2007)

This biological evaluation was prepared in accordance with Forest Service Manual (FSM) direction 2672.42 and meets legal requirements set forth under Section 7 of the Endangered Species Act of 1973, as amended, and implementing regulations [19 U.S.C. 1536 (c), 50 CFR 402.12 (f) and 402.14 (c)].

Literature cited and references throughout this biological evaluation can be found at the end of the document, first by general resource documents then by individual species or species group.

III. CONSULTATION TO DATE

The Fish and Wildlife Service is contacted every 90 days to obtain a current list of threatened, endangered, proposed, and candidate species that may be present in Tahoe National Forest. The most recent list was reported November 8, 2012, and is available for review at the District Office.

Forest plans for national forests lying within the Sierra Nevada were amended under the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001 and 2004). The Regional Forester consulted with the

California and Nevada Operations Office of Fish and Wildlife Service for that amendment. The Biological Opinion is dated January 11, 2001. The determination in the biological opinion is that the selected action is not likely to jeopardize the continued existence of species listed pursuant to the Act (bald eagle (subsequently delisted), California red-legged frog, valley elderberry longhorn beetle, Lahontan cutthroat trout). No terms or conditions were provided. Conservation recommendations are discussed in the corresponding species portions of this Biological Evaluation/Biological Assessment if they are applicable to Tahoe National Forest species and management activities.

IV. CURRENT MANAGEMENT DIRECTION

Current management direction on desired future conditions for Threatened, Endangered and Sensitive species in Tahoe National Forest can be found in the following documents, filed at the District Office:

-Forest Service Manual and Handbooks (FSM/FSH 2670)
-National Forest Management Act (NFMA)
-Endangered Species Act (ESA)
-National Environmental Policy Act (NEPA)
-Tahoe National Forest Land and Resource Management Plan as amended by the Sierra Nevada Forest Plan Amendment Record of Decision (January 2001) and Sierra Nevada Forest Plan Amendment, Final Supplemental Environmental Impact Statement Record of Decision (January 2004)
-Species specific Recovery Plans which establish population goals for recovery of those species
-Species management plans
-Species management guides or conservation strategies
-Regional Forester policy and management direction

The January 2004 Record of Decision for the Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement (SNFPA 2004; USDA Forest Service 2004) replaces the January 2001 Record of Decision for the Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement (SNFPA 2001; USDA Forest Service 2001) in its entirety. Detailed information including specific standards and guidelines for species management can be found in the SNFPA 2004. The standards and guidelines in the January SNFPA 2001 are incorporated by reference.

All Threatened, Endangered and Sensitive species are included in the Tahoe National Forest LRMP list of Management Indicator Species. General Forest Service direction for Threatened, Endangered and Sensitive species is summarized below:

FSM 2670.31 THREATENED AND ENDANGERED SPECIES

1) Place top priority on conservation and recovery of endangered, threatened, and proposed species and their habitats through relevant National Forest System, State and Private Forestry, and Research activities and programs.
2) Establish through the Forest planning process objectives for habitat management and/or recovery of populations, in cooperation with States, the USFWS, and other Federal agencies.
3) Through the biological evaluation process, review actions and programs authorized, funded, or carried out by the Forest Service to determine their potential for effect on threatened and endangered species and species proposed for listing.

4) Avoid all adverse impacts on threatened and endangered species and their habitat except when it is possible to compensate adverse effect totally through alternatives identified in a biological opinion rendered by the USFWS, or when the USFWS biological opinion recognizes an incidental taking. Avoid adverse impacts on species proposed for listing during the conference period and while their Federal status is being determined.
5) Initiate consultation or conference with the USFWS when the Forest Service determines that proposed activities may have an adverse effect on threatened, endangered, or proposed species or when Forest Service projects are for the specific benefit of a threatened or endangered species
6) Identify and prescribe measures to prevent adverse modification or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species. Protect individual organisms or populations from harm or harassment as appropriate.

FSM 2670.32 SENSITIVE SPECIES

1) Assist States in achieving their goals for conservation of endemic species.
2) As part of the National Environmental Policy Act process, review programs and activities, through a biological evaluation, to determine their potential effect on sensitive species.
3) Avoid or minimize impacts to species whose viability has been identified as a concern.
4) If impacts cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole.
5) Establish management objectives in cooperation with the States when a project on National Forest System lands may have a significant effect on sensitive species population numbers or distribution. Establish objectives for Federal candidate species, in cooperation with the USFWS and the States.

V. DESCRIPTION OF THE PROPOSED PROJECT AND ALTERNATIVES

The Sagehen Project was designed using concepts based upon *An Ecosystem Management Strategy for Sierran Mixed-Conifer Forests* (North et al. 2009), also referred to as General Technical Report (GTR) 220. GTR 220 presents a comprehensive overview of the recent scientific literature regarding mixed conifer stands in the Sierra Nevada and provides a framework for management approaches that strive to achieve ecological restoration through enhanced forest resiliency, increase wildlife habitat diversity, and reduce hazardous fuels using topographic variables (i.e., slope shape, aspect, and slope position) as a tool for varying silvicultural and fuels treatments.

Emphasis Area Creation: The topographic variation within the basin facilitated the development of emphasis areas based on forest structure and composition within the Basin. For each emphasis area, silvicultural prescriptions were developed according to a particular unit's location on the slope instead of just relying on its current vegetative condition. This method not only allows for more variability at the landscape scale, but also facilitates prescriptions that mimic more natural processes according to its position on the landscape.

Sagehen Project Area Map

Each emphasis area is represented by a different color on the proposed action Map (Map 1). These colors translate into subunits within the proposed treatment unit boundaries. For example, in treatment unit 38, the two discontinuous green areas are both emphasis area 1 and they are both designated subunit 38-1. In another example, treatment unit 213 is comprised of emphasis areas 1 (green), 2 (blue), 4 (fuchsia), 5 (gray), 6 (orange), and 7 (yellow). It therefore has subunits 213-1, 213-2, 213-4, 213-5, 213-6, and 213-7.

Emphasis Area 1

Emphasis area 1 generally represents north facing slopes, but in order to accommodate other project goals, vegetative conditions were incorporated into this emphasis area which grouped some topographic features together. Therefore emphasis area 1 (green areas on Map 1) is predominantly north facing slopes, but does include some ridges, and some higher elevation south facing slopes (above 6,725 feet). Within the treatment units, approximately 453 acres are identified as emphasis area 1 (see Table 3 below)

Emphasis Area 3

Emphasis area 3 represents south facing slopes, but in order to accommodate other project goals, vegetative conditions were incorporated into this emphasis area which created a small, but unique condition set. Because emphasis area 3 is very limited in total area, it was combined with either emphasis area 1 or emphasis area 2 whichever was closer. Therefore there is no mapped emphasis area 3 and there are no metrics assigned to it. Because numbers were already assigned to emphasis areas when emphasis area 3 was combined with others, re-numbering was not done. This discussion is intended to reduce confusion as to why emphasis area 3 is not shown on the map and why it will not be discussed further in this document.

Emphasis Areas 2 and 4

Emphasis areas 2 (blue areas on Map 1) and 4 (fuchsia areas on Map 1) include the drainage bottoms. In order to accommodate other project goals, vegetative conditions were incorporated into the analysis of these two emphasis areas which parsed them accordingly. So although there are different current vegetative conditions in each emphasis area, they both reside in drainage bottoms and could potentially support similar amounts and types of vegetation. These areas include perennial stream courses, meadows, and other intermittent and ephemeral drainages throughout the Basin. These locations tend to be relatively more mesic, retain moisture longer through the season and generally support more dense and diverse vegetation conditions than the surrounding stands. They tend to have more herbaceous vegetation cover and microhabitats. By contrast, some drainages tend to be relatively more xeric and have fewer to no adjoining wet meadows or similar features. Under these conditions these areas still retain moisture for a longer period of the year than surrounding stands and tend to support denser vegetation and often larger trees. Within the treatment units, approximately 103 acres are identified as emphasis area 2 and 173 acres are identified as emphasis area 4 (see Table 3 below).

Emphasis Area 5

Emphasis area 5 (gray areas on Map 1) represents north facing slopes. Due to the more northerly exposure, emphasis area 5 would support more basal area and canopy cover as compared to ridges and south facing slopes. However it would support less basal area and canopy cover than drainages, because of the more xeric conditions. Within the treatment units, approximately 1,028 acres are identified as emphasis area 5 (see Table 3 below).

Emphasis Areas 6 and 7

Emphasis area 6 (orange areas on Map 1) represents south facing slopes and emphasis area 7 (yellow areas on Map 1) represents ridges. Overall, emphasis areas 6 and 7 would potentially support less basal area and canopy cover than in emphasis areas 1-5, with ridges (emphasis area 7) potentially supporting the least. Within the treatment units, approximately 740 acres are identified as emphasis area 6 and 150 acres are identified as emphasis area 7 (see Table 3 below).

Emphasis Area 8

Emphasis area 8 (purple areas on Map 1) is unique in that only vegetative conditions were used to demarcate the emphasis area. The vegetation condition focus was on aspen stands with conifer encroachment that reside within treatment unit boundaries. This emphasis area does not represent all aspen stands within the Basin. Within the treatment units, approximately 6 acres are identified as emphasis area 8 (see Table 3 below).

Proposed Alternatives

The Sagehen Project consists of three alternatives: the proposed action (Alternative 1), no action alternative (Alternative 2), and the non-commercial funding alternative (Alternative 3). The following section provides a summary of the alternatives. See the Sagehen Project Environmental Assessment for a more detailed description.

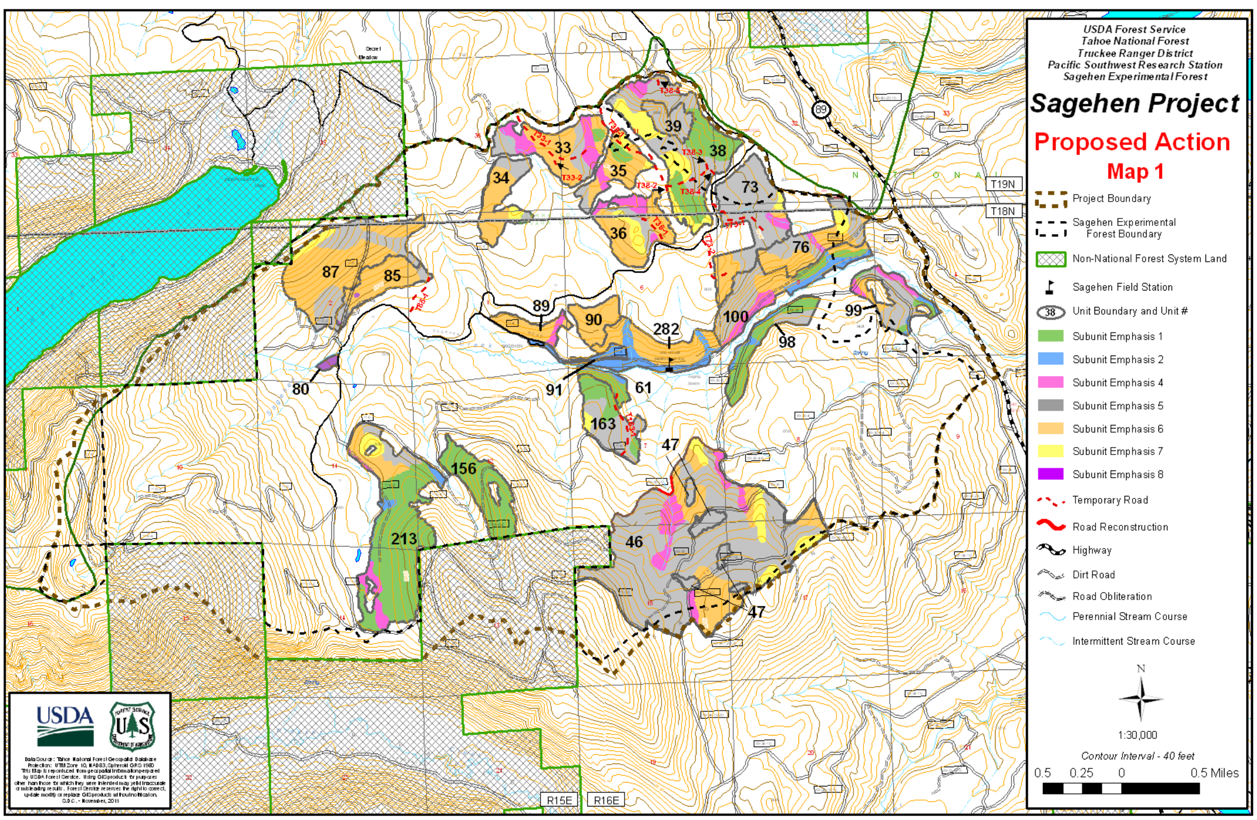

Figure1. Sagehen Project – Proposed Action Map

Alternative 1 (Proposed Action) –

Table 3. Alternative 1 (Proposed Action) Proposed Activities

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Silvicultural Rx – *see Order of Prescription Application section above*	Silvicultural Treatment Method	Fire/Fuels Rx	Fire/Fuels Treatment Method
33	118	1	4	Variable Thin, Legacy Tree Treatment, Suppressed Cut, Dense Cover Area, Early Seral Opening, Decadent Feature Enhancement	Mechanical	Pile Burn Rx	Grapple Pile Pile Burn
		4	30				
		5	28				
		6	56				
34	68	5	16	Variable Thin, Legacy Tree Treatment, Suppressed Cut, Dense Cover Area, Early Seral Opening, Decadent Feature Enhancement	Mechanical	Surface Fire Rx	Underburn
		6	47				
		7	5				
35	64	1	8	Variable Thin, Legacy Tree Treatment, Suppressed Cut, Dense Cover Area, Early Seral Opening, Decadent Feature Enhancement	Mechanical	Pile Burn Rx	Grapple Pile Pile Burn
		4	6				
		5	7				
		6	37				
		7	6				
36	101	4	18	Variable Thin, Legacy Tree Treatment, Suppressed Cut, Dense Cover Area, Early Seral Opening, Decadent Feature Enhancement	Mechanical	Pile Burn Rx	Grapple Pile Pile Burn
		5	13				
		6	56				
		7	14				
38	210	1	67	Variable Thin, Legacy Tree Treatment, Suppressed Cut, Dense Cover Area, Early Seral Opening, Decadent Feature Enhancement	Mechanical	Surface Fire Rx	Underburn
		4	7				
		5	86				
		7	50				
39	32	5	32	No Treatment	N/A	Surface Fire Rx	Underburn
46	621	4	47	No Treatment	N/A	Surface Fire Rx	Underburn
		5	431	Plantation Thin	Mechanical	Lop &	Masticati

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Silvicultural Rx – *see Order of Prescription Application section above*	Silvicultural Treatment Method	Fire/Fuels Rx	Fire/Fuels Treatment Method
		6	105		Mastication	Scatter Surface Fire Rx	on Underburn
		7	38				
47	33	5	33	No Treatment	N/A	Surface Fire Rx	Underburn
61	20	1	15	Variable Thin, Suppressed Cut, Dense Cover Area	Hand	Pile Burn Rx Surface Fire Rx	Hand Pile Pile Burn Underburn
		2	5				
73	144	4	6	Variable Thin, Legacy Tree Treatment, Suppressed Cut, Dense Cover Area, Early Seral Opening, Decadent Feature Enhancement	Mechanical	Surface Fire Rx	Underburn
		5	107				
		6	27				
		7	4				
76	91	4	4	No Treatment	N/A	Surface Fire Rx	Underburn
		5	37	Plantation Thin	Mechanical Mastication	Lop & Scatter Surface Fire Rx	Mastication Underburn
		6	42				
		7	8				
80	5	8	5	Aspen Restoration	Hand	Pile Burn Rx	Hand Pile Pile Burn
85	64	5	10	Variable Thin, Legacy Tree Treatment, Suppressed Cut, Dense Cover Area, Early Seral Opening, Decadent Feature Enhancement	Mechanical Mastication	Lop & Scatter	Mastication
		6	53				
		8	1	Aspen Restoration	Mechanical	N/A	N/A
87	207	5	67	Plantation Thin	Mechanical Mastication	Lop & Scatter	Mastication
		6	130				
		7	10				
89	34	4	6	Variable Thin, Legacy Tree Treatment, Suppressed Cut, Dense Cover Area, Early Seral Opening, Decadent Feature Enhancement	Mechanical	Surface Fire Rx	Underburn
		6	28				
90	40	6	40	Variable Thin, Legacy Tree Treatment, Suppressed Cut, Dense Cover Area,	Mechanical	Surface Fire Rx	Underburn

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Silvicultural Rx – *see Order of Prescription Application section above*	Silvicultural Treatment Method	Fire/Fuels Rx	Fire/Fuels Treatment Method
				Early Seral Opening, Decadent Feature Enhancement			
91	9	2	9	Variable Thin, Suppressed Cut, Dense Cover Area	Hand	Pile Burn Rx	Hand Pile Pile Burn
98	63	1	43	Variable Thin, Suppressed Cut, Dense Cover Area	Hand	Pile Burn Rx	Hand Pile Pile Burn
		2	9				
		5	11				
99	67	1	7	Variable Thin, Suppressed Cut, Dense Cover Area	Hand	Pile Burn Rx	Hand Pile Pile Burn
		2	4				
		4	11				
		5	37	Plantation Thin	Mechanical Mastication	Lop & Scatter	Mastication
		6	8				
100	120	1	14	Variable Thin, Suppressed Cut, Dense Cover Area, Decadent Feature Enhancement	Hand	Pile Burn Rx Surface Fire Rx	Hand Pile Pile Burn Underburn
		2	19				
		4	17				
		5	46				
		6	24				
156	84	1	84	Variable Thin, Legacy Tree Treatment, Suppressed Cut, Dense Cover Area, Early Seral Opening	Mechanical	Pile Burn Rx	Grapple Pile Pile Burn
163	82	1	29	Variable Thin, Legacy Tree Treatment, Suppressed Cut, Dense Cover Area, Early Seral Opening, Decadent Feature Enhancement	Mechanical	Pile Burn Rx Surface Fire Rx	Grapple Pile Pile Burn Underburn
		5	49				
		7	4				
213	268	1	182	Variable Thin, Legacy Tree Treatment, Suppressed Cut, Dense Cover Area, Early Seral Opening, Decadent Feature Enhancement	Mechanical	Pile Burn Rx	Grapple Pile Pile Burn
		2	11				
		4	21				
		5	18				
		6	25				
		7	11				
282	108	2	46	Variable Thin, Suppressed Cut, Dense Cover Area	Hand	Pile Burn Rx Surface Fire Rx	Hand Pile Pile Burn Underburn
		6	62				

Silvicultural Prescriptions and Treatment Methods:

Silvicultural Prescriptions

Dense Cover Areas (DCAs) and Early Seral Openings (ESOs)

Units: 33, 34, 35, 36, 38, 61, 73, 89, 90, 91, 98, 100, 156, 163, 213, 282 (all emphasis areas), 85 – emphasis areas 5 and 6, and 99 -emphasis areas 1, 2 and 4.

Dense cover areas (DCAs) are small areas distributed within treatment units that provide continuous vertical and horizontal cover with a mixture of shrubs and trees along with large and small down wood, snags, and high stumps. DCAs would typically contain clumps of trees of various size classes as well as a variety of snag and down wood sizes. These existing DCAs, ranging in size from 0.25-1 acre, would contribute to/enhance within-stand horizontal and vertical structural diversity and provide important old forest and/or mid seral habitat elements. ESOs would be comprised of dense young regenerating trees and/or shrubs to provide early successional habitat within larger stands managed for late successional or old forest habitat. ESOs, from 0.25-0.50 acre, would enhance within-stand age and species diversity. In some cases, there can actually be a mix of DCAs and ESOs such as around fens. For example, some DCAs are planned around small fens in units 46, 85, and 98. The area would encompass not only the fen but also some of the surrounding forest stand. Both vertical structural diversity and an early seral stage would be represented.

Two primary methods would be used to retain and create DCAs or ESOs: For DCAs, an area would be designated that has multiple structural elements, such as large down woody material, a mixture of tree age classes (including solitary and groups of large trees), large snags, multiple tree canopy layers; and/or trees with features associated with wildlife use (for example, platforms, mistletoe brooms, forked tops, and cavities). No mechanical tree removal would be conducted in these "existing DCAs". For ESOs, by taking advantage of existing conditions, such as areas of sparse tree cover, thinner soils, or pockets of extensive tree mortality, openings would be created by removing most or all of the existing trees and either planting or allowing natural shrub and/or tree regeneration to create an ESO of early successional habitat.

Table 4: Acres of Proposed Dense Cover Areas and Early Seral Openings Treatment

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Dense Cover Area Acres	Early Seral Opening Acres
33	118	1	4	1.08	0
		4	30	3.03	0
		5	28	2.28	2.02
		6	56	1.85	4.07
34	68	5	16	1.46	.93
		6	47	1.36	1.98
		7	5	0	.53
35	64	1	8	1.47	0
		4	6	.58	0
		5	7	.48	.54

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Dense Cover Area Acres	Early Seral Opening Acres
		6	37	1.03	2.04
		7	6	0	.32
36	101	4	18	2.64	0
		5	13	1	.36
		6	56	1.89	3.27
		7	14	0	1.08
38	210	1	67	7.5	3.3
		4	7	.48	0
		5	86	4.96	4.09
		7	50	0	3.02
39	32	5	32	0	0
46	621	4	47	0	0
		5	431	0	0
		6	105	0	0
		7	38	0	0
47	33	5	33	0	0
61	20	1	15	2	0
		2	5	.5	0
73	144	4	6	1.03	0
		5	107	5.86	4.36
		6	27	.47	1.59
		7	4	0	.48
76	91	4	4	0	0
		5	37	0	0
		6	42	0	0
		7	8	0	0
80	5	8	5	0	0
85	64	5	10	.69	.44
		6	53	1.92	2.34
		8	1	0	0
87	207	5	67	0	0
		6	130	0	0
		7	10	0	0
89	34	4	6	.6	0
		6	28	1.13	1.4
90	40	6	40	1.12	1.21
91	9	2	9	.5	0
98	63	1	43	7	0
		2	9	.5	0
		5	11	.5	0

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Dense Cover Area Acres	Early Seral Opening Acres
99	67	1	7	1	0
		2	4	.5	0
		4	11	1	0
		5	37	0	0
		6	8	0	0
100	120	1	14	2	0
		2	19	1	0
		4	17	3.5	0
		5	46	1.5	0
		6	24	1.5	0
156	84	1	84	6.19	2
163	82	1	29	4.18	1.95
		5	49	2.72	2.08
		7	4	0	.5
213	268	1	182	15.83	5.6
		2	11	1.03	0
		4	21	3.07	0
		5	18	.86	1.02
		6	25	.91	.87
		7	11	0	1
282	108	2	46	2.5	0
		6	62	3.5	0
Totals				110	54

Legacy Tree Treatment

Units: 33, 34, 35, 36, 38, 73, 89, 90, 156, 163, 213 (all emphasis areas), and 85- emphasis areas 5 and 6.

Legacy trees are the largest and/or oldest trees within a stand and tend to be at least a generation older than the trees in the surrounding forest. Legacy trees can occur singly or in groups, and often represent tree species that would occur under active fire conditions under an active fire regime.

Legacy trees are not present within every stand, and, as a general rule, are somewhat rare in the Sagehen Project Area's forest stands, typically occurring at a density of one to two legacy trees per five acres. As with many other forest structural features, this value varies considerably depending on site history and conditions.

The legacy tree treatment prescription is applied after the DCAs and ESOs are identified. In some cases legacy trees may occur within a DCA. In this case the DCA trumps the legacy tree treatment and trees surrounding the legacy tree are retained in the DCA. In other cases, a legacy tree may occur on the edge of an ESO. In this case, the ESO would be designed to, in effect, implement a partial legacy tree treatment in that trees removed in the ESO would also be trees that would have been removed in the legacy tree treatment. Legacy tree treatments would not be used to expand the resulting sizes of ESOs.

In some of the Project Area plantations, there are trees that survived the wildfires and subsequent salvage harvest, in these cases the trees are referred to as “residual” trees. While they do meet the definition of legacy trees, they occur in large enough groups that they would be treated differently than individual or small groups of legacy trees, see the Plantation Thinning prescription below.

Legacy tree treatment would involve removing trees up to 30 inches dbh around the legacy tree, however, existing stand structure would dictate the sizes of trees (up to a 30 inch dbh limit) to be removed.

This treatment is designed to increase the resiliency of large legacy trees from the effects of fire, drought, pathogens, and disease. Removing trees from around the legacy tree(s) accelerates tree root and diameter growth, thereby improving overall legacy tree health and resiliency. In addition, the removal of smaller, understory trees, particularly the shade tolerant, less fire-resistant white fir, removes ladder fuels, which could carry fire into the canopy of the legacy tree(s).

The distance of the tree removal around legacy tree(s) would be variable, based on site-specific conditions (such as extent of the drip line, aspect, and topography).

Variable Thinning
Units: 33, 34, 35, 36, 38, 61, 73, 89, 90, 91, 98, 100, 156, 163, 213, 282 (all emphasis areas), 85-emphasis areas 5 and 6, and 99 emphasis areas 1, 2, and 4.

The variable thinning prescription is highly site-specific, set within the context of the existing stand’s structure and tree species composition. In general, variable thinning involves selective removal and retention of individual codominant and subdominant trees and/or small groups of codominant and subdominant trees. Variable thinning would occur throughout the areas outside of dense cover areas, early seral openings, and legacy tree treatment areas, varying by the prescriptions designed for each emphasis area. Thinning would be conducted to meet treatment subunit level objectives of basal area, canopy cover, tree species composition, and fire behavior), and to increase stand level structural heterogeneity. On-the-ground decisions about which individual trees and groups of trees to retain would be made in light of (1) ensuring overall stand structure would remain intact following application of prescribed fire and (2) mimicking stand structures that would develop under active fire conditions.

Variable thinning objectives include: (a) enhancing stand heterogeneity (by retaining groups of larger trees that can provide valuable wildlife habitat and creating subtle openings by thinning around these groups), (b) reducing fuels, and (c) work towards stand level ecological restoration. Variable thinning would be applied using the following guidelines:

- Generally favor retention of pines over firs, especially in southerly facing areas and on ridges. In areas of more fir dominance, give retention preference to red fir over white fir. Retained groups of larger trees (described under the bullet below) may include fir trees. Overall the emphasis for retained groups of trees is preserving or enhancing desirable stand structure rather managing for any particular species composition.

- Retain groups of larger trees, generally comprised of five to ten (or more) trees of roughly similar size. Ideally, some of the retained trees should have desirable habitat features, such as forked or broken tops. Remove trees adjacent to these retained groups to improve the overall health and resiliency of the group to drought, insects and disease.
- Where a few (less than five) trees occur together, or where trees are scattered, retain the more vigorous trees by removing subdominant and, in some cases, codominant trees around them to reduce ladder fuels and competition for light, water, and nutrients.
- In areas of greater fir dominance where large trees tend to grow in more of a clumped nature, emphasize retaining clumps, or groups, of generally five to ten trees, and removing trees adjacent to these retained clumps to create small, variably shaped gaps.
- When making site-specific determinations on individual tree removal/retention preferences, vary the choices made so as to increase the variability at the micro-site scale.

Suppressed Cut

Units: 33, 34, 35, 36, 38, 61, 73, 89, 90, 91, 98, 100, 156, 163, 213, 282 (all emphasis areas), 85-emphasis areas 5, 6, and 99- emphasis areas 1, 2, 4.

A suppressed tree is typically no larger than ten inches dbh (usually ranging between one and five inches dbh) *and* is a component of a stand's understory, where there is an overstory of dominant, codominant, and subdominant trees. Suppressed trees, in general, have little capacity to release (initiate increased growth rates), even if the overstory is removed. These trees often make up the lower levels of ladder fuels, and the suppressed tree layer combined with subdominant trees helps connect the forest floor into the crowns of dominant/codominant trees, which can increase fire severity and the potential for crown fire.

The suppressed cut would remove suppressed trees (down to one inch dbh for hand thinning and down to three inches dbh for mechanical thinning), as described above, within treatment units outside of dense cover areas. The suppressed cut prescription would not be applied within dense cover areas. This would retain a percentage of the suppressed tree size class within the treatment units, enhancing within-stand variability from a tree size standpoint. Suppressed tree removal outside dense cover areas would facilitate use of prescribed fire while helping to minimize the risks of crown fire by removing some ladder fuels.

Plantation Thinning

Units: 87 (all emphasis areas), 46- emphasis areas 5, 6, and 7, 76- emphasis areas 5, 6, and 7, and 99-emphasis areas 5 and 6.

Plantations in the Sagehen Project Area were established in the 1960s and 1970s following the Independence and Donner Ridge wildfires. The plantations are largely comprised of planted Jeffrey and some ponderosa pines; however, they also contain young trees that grew in naturally. The plantation thinning prescription is designed to facilitate and accelerate the continued growth of these young trees. The plantations currently contain some trees that survived wildfire and subsequent salvage harvest: these "residual" trees would not be removed. While they do meet the definition of legacy trees, residual trees in plantations would be treated differently than individual or small groups of legacy trees with a focus on removing ladder fuels to protect them during prescribed burning treatments. There also would be an emphasis on removing ladder fuels on the downhill sides of the residual trees where steep slopes may contribute to flame lengths reaching the residual trees.

Plantation thinning would involve mechanical thinning and/or mastication (mechanical grinding and crushing that *rearranges* material on site) of plantation trees and mastication of shrubs. Mastication changes a vertical large piece of fuel (i.e. a standing tree) into many smaller pieces of horizontal fuel. The plantation thinning prescription would primarily focus on removing and/or rearranging trees between one and 12 inches dbh. An occasional tree between 12 and 18 inches dbh could be removed; however, this would occur only where mechanical cutting and removal systems were used. The majority of trees between 12 and 18 inches dbh would be retained. Typically, retained trees would be spaced roughly 14 to 22 feet apart; however, where logistically possible, existing variable stand structure would be used to increase within-stand horizontal heterogeneity such that there would be some more dense and more open areas.

Plantation thinning would retain at least 120 trees per acre. Sufficient tree canopy cover would be maintained to suppress shrub growth under groups of trees; however, retarding shrub growth over the entire treatment unit would not be a specific objective. Although the primary objective of plantation thinning is to accelerate the growth of retained trees, a secondary objective is to foster some within-stand defect trees. To meet this secondary objective, plantation thinning would retain an average of ten to 12 trees per acre with injuries, split tops, and/or porcupine damage.

Shrubs growing under the drip line of retained trees would be masticated. Other areas of snow brush, manzanita, and white thorn outside the drip lines would also be masticated to decrease the fire hazard and provide opportunities for brush regeneration. Further, patches of bitterbrush and gooseberry outside of tree drip lines would not be masticated unless they posed a fire hazard (ladder fuels) to retained trees/groups of trees. Bitterbrush is a preferred browse species for mule deer and it occurs in some homogeneous small patches in the plantations. These patches provide valuable foraging habitat. Because bitterbrush and gooseberry do not regenerate (stump sprout) very well after mastication, unless posing a direct ladder fuels hazard, these species would not be masticated.

Areas containing "residual" trees as well as areas that currently have less than ten trees per acre, which would not be mechanically thinned or masticated, would serve functions similar to DCAs and ESOs in the treated plantations. In addition, identified drainage bottoms within plantations would not be treated, providing additional areas like DCAs. Based on existing conditions in the plantation treatment units, it is estimated that at least ten percent of the overall plantation acreage would be included in these residual tree zones, sparsely treed areas, and drainages. These areas would enhance heterogeneity in the treated plantations.

Aspen Restoration
Units: 80- emphasis area 8, and 85- emphasis area 8.

An aspen restoration prescription involves selectively removing conifers from stands of aspen that are at risk of loss because they are being crowded and shaded by thickets of small lodgepole pine or they are being overtopped by conifers. These stands typically have a much higher percentage of conifers than aspen, and have little aspen regeneration. Conifer removal would occur by hand cutting or mechanical cutting methods. When treated by hand, typically most conifers from one to 16 inches dbh would be cut and removed from site and larger conifers girdled to create snags. When treated by mechanical means, conifers greater than three inches dbh that are overtopping and/or crowding aspens would be removed.

Decadent Feature Enhancement
Units: 33 – all emphasis areas, 34 – emphasis areas 5 and 6, 35 – emphasis areas 1, 4, 5 and 6, 36 – emphasis areas 4, 5, and 6, 38 – emphasis areas 1, 4, and 5, 73 – emphasis areas 4, 5, and 6, 85 – emphasis areas 5 and 6, 89 – all emphasis areas, 90 – all emphasis areas, 100 – emphasis areas 1 and 2, 163 – emphasis areas 1 and 5, 213 – emphasis areas 1, 2, 4, 5 and 6.

This prescription encompasses two different treatments; partial tree girdling and short snag creation. Partial tree girdling would occur inside and outside of DCAs and short snag creation would only occur in DCAs. Both treatments would only be applied in subunits where the current snag/short snag densities are substantially below desired densities.

Partial tree girdling would involve girdling (cutting off the bark layer deep enough to sever the tree's vascular system in the cambium) of individual trees 15-30 inches dbh. The bark layer would be removed in a 6-12 inch band covering approximately ⅓ of the diameter of pine trees and ½ of the diameter of fir trees. The goal of this treatment is to selectively wound and therefore weaken trees. These weakened trees would become more susceptible to environmental stresses, insect attack, and/or fungus/rot infection and therefore become snags likely before a neighboring, non-girdled tree would. By partially girdling and wounding trees, it is anticipated that the trees would become snags over a longer timeframe rather than die immediately, like what would happen if a tree were completely girdled.

The selection of trees for partial tree girdling would occur after the DCA and ESO, legacy tree treatment, variable thinning and suppressed cut prescriptions had been applied (marked). Trees selected outside of DCAs for partial girdling would be trees already selected under the variable thinning prescription for removal. Therefore these trees would be accounted for when calculations of basal area removal and trees removed per acre are tallied, however they would be left on site. These trees would be among the largest trees available (under 30 inches dbh). Trees selected for partial girdling in DCAs would be designated based on the site specific conditions in the DCAs and would be trees that would provide needed habitat structure in the DCAs.

Short snag creation involves cutting a tree (preferentially a white fir), on the outside edge, but within a DCA, at a height of 10-20 feet above the ground. The height would be based on the highest point a piece of machinery such as a feller buncher, could reach to cut the tree. The top of the tree would be felled into the interior of the DCA and left to contribute to down log densities. Trees selected for this treatment would be 15-30 inches dbh. The goal of this treatment is to immediately create snags at an intermediate height inside of DCAs. These short snags would be expected to provide suitable perches/rest sites and would be tall enough to be above typical snow levels, thus also providing an access route under the snow for wildlife.

Table 5: Decadent Feature Enhancement

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	# of Partial Girdled Trees Created outside DCA	# of Partial Girdled Trees Created inside DCA	# of Short Snags Created inside DCA
33	118	1	4	7	1	2
		4	30	0	0	6
		5	28	36	2	4
		6	56	0	2	2
34	68	5	16	0	0	3
		6	47	0	0	2
		7	5	0	0	0
35	64	1	8	6	1	2
		4	6	0	0	1
		5	7	7	1	1
		6	37	0	0	1
		7	6	0	0	0
36	101	4	18	0	0	6
		5	13	20	1	2
		6	56	0	0	1
		7	14	0	0	0
38	210	1	67	0	0	19
		4	7	0	0	1
		5	86	0	0	9
		7	50	0	0	0
39	32	5	32	0	0	0
46	621	4	47	0	0	0
		5	431	0	0	0
		6	105	0	0	0
		7	38	0	0	0
47	33	5	33	0	0	0
61	20	1	15	0	0	0
		2	5	0	0	0
73	144	4	6	0	0	2
		5	107	0	0	16
		6	27	0	0	1
		7	4	0	0	0

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	# of Partial Girdled Trees Created outside DCA	# of Partial Girdled Trees Created inside DCA	# of Short Snags Created inside DCA
76	91	4	4	0	0	0
		5	37	0	0	0
		6	42	0	0	0
		7	8	0	0	0
80	5	8	5	0	0	0
85	64	5	10	11	1	1
		6	53	0	0	2
		8	1	0	0	0
87	207	5	67	0	0	0
		6	130	0	0	0
		7	10	0	0	0
89	34	4	6	0	0	2
		6	28	0	0	1
90	40	6	40	0	0	1
91	9	2	9	0	0	0
98	63	1	43	0	0	0
		2	9	0	0	0
		5	11	0	0	0
99	67	1	7	0	0	0
		2	4	0	0	0
		4	11	0	0	0
		5	37	0	0	0
		6	8	0	0	0
100	120	1	14	48	2	0
		2	19	36	1	0
		4	17	0	0	0
		5	46	0	0	0
		6	24	0	0	0
156	84	1	84	0	0	0
163	82	1	29	0	0	8
		5	49	0	0	5
		7	4	0	0	0
213	268	1	182	237	14	30
		2	11	32	1	2
		4	21	41	3	6
		5	18	32	1	2
		6	25	0	0	1
		7	11	0	0	0
282	108	2	46	0	0	0

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	# of Partial Girdled Trees Created outside DCA	# of Partial Girdled Trees Created inside DCA	# of Short Snags Created inside DCA
		6	62	0	0	0
Totals				**513**	**31**	**142**

Silvicultural Treatment Methods

Mechanical Thinning

Units: 33, 34, 35, 36, 38, 73, 85, 87, 89, 90, 156, 163, 213 (all emphasis areas), 46 - emphasis areas 5, 6, and 7, 76- emphasis areas 5, 6, and 7, 99 - emphasis areas 5 and 6.

Mechanical thinning is a harvest activity, which, under the Sagehen Project would utilize ground-based equipment (tractors, feller bunchers and some chainsaw work) to fell and remove identified trees while retaining and protecting desirable trees to accomplish fuels reduction, marten habitat enhancement and restoration, and stand level ecological restoration objectives set within each treatment unit. A network of skid trails (in the case of ground-based thinning operations), landings, and, in some cases, temporary roads (which are removed following project activities) would be used to transport and collect harvested material. This equipment would operate on slopes generally less than 25 percent. Short pitches less than 150 feet long and up to 30 percent in slope would also be included in treatments using ground based equipment. A borate compound would be applied to all white fir stumps greater than 14 inches in diameter to prevent Annosus root disease.

Hand Thinning

Units: 61, 80, 91, 98, 100, 282 (all emphasis areas), 99 - emphasis areas 1, 2, and 4.

Hand thinning is an activity that utilizes crews with chainsaws or handsaws that cut understory conifers less than 16 inches dbh to accomplish fuels reduction, marten habitat enhancement and restoration, and stand-level ecological restoration objectives set for the treatment unit. If hand felled material contributes to unacceptable fuel loading, this material may be hand piled outside the drip lines of desirable trees and burned when conditions permit a minimum amount of mortality.

Mastication

Units: 87 (all emphasis areas), 46 - emphasis areas 5, 6, and 7, 76- emphasis areas 5, 6, and 7, 85 - emphasis areas 5 and 6, 99- emphasis areas 5 and 6.

A masticator is a low ground pressure piece of equipment that “chews” up brush and small understory trees to reduce competition. The machine mechanically grinds and crushes this material and down woody fuels and distributes the resulting small pieces around the site. This equipment would operate on slopes generally less than 25 percent. Short pitches less than 150 feet long and up to 30 percent in slope would also be included in treatments using ground based equipment.

Mastication is also a Fire/Fuels Treatment Method – see below.

Fire/Fuels Prescriptions

Surface Fire Prescription
Units: 34, 38, 39, 46, 47, 61, 73, 76, 89, 90, 100, 163, 282 (all emphasis areas).

A surface fire is a fire that burns live and dead fuels at or near the surface of the ground, mostly by flaming combustion. A surface fire prescription is usually implemented by an underburn. Surface fire prescriptions are typically designed to consume surface and ladder fuels and to mimic fire that would occur in an active fire regime. Surface fire prescriptions can be applied under spring-like and fall-like conditions. Spring-like conditions are defined by relatively high live fuel moistures, high 1000 hour size ("coarse woody debris", three inches diameter and greater) fuel moistures, and soils that are relatively moist beneath the surface fuels. Under spring-like conditions, it is expected that surface fires would have moderate to high consumption of 1-100 hour size fuels ("fine woody debris", ranging from 0.00-2.99 inches diameter) and minimal consumption of 1000+ hour fuels with mortality primarily expected in subdominant tree size classes. Fall-like conditions are defined by relatively low live fuel moistures, lower 1000 hour fuel moistures, and drier soils with dry organic layers beneath the litter layer. Under fall-like conditions, it is expected that burning would be primarily surface fires with higher flame lengths, and faster burn times as compared to burning under spring-like conditions. It would have high consumption of 1-100 hour size fuels and moderate to high consumption of 1000+ hour fuels, and with mortality expected in subdominant and some codominant tree size classes. Depending on cycles of drought and wet weather, spring-like and fall-like conditions can occur throughout the year. For the Sagehen Project, spring-like condition surface fire prescriptions would be emphasized, however due to limited suitable burning conditions, surface fire prescriptions under fall-like conditions would be implemented in some cases. In these cases, extra measures to protect large dead wood, such as creating firelines around large logs/snags, would be implemented.

Pile Burn Prescription
Units: 33, 35, 36, 61, 80, 91, 98, 100, 156, 163, 213, 282 (all emphasis areas), 99 - emphasis areas 1, 2, and 4.

A pile burn prescription is designed to remove surface fuels, both fuels generated from silvicultural treatments (activity fuels) and existing fuels on the ground. A pile burn prescription can be implemented by hand or by machinery (typically a grapple piler – see below). In general, small down wood is placed in piles for future burning. Pile location and size is dictated by existing conditions, however piles would be preferentially placed outside of sensitive areas such as riparian conservation areas and cultural resource sites. Piles of fuels typically are burned under fall-like conditions, in winter months, or during periods of low fire danger. This prescription removes surface fuels in the treatment units and is used to mimic underburning where sensitive areas prevent unit-wide application of underburning.

Lop and Scatter
Units: 87 (all emphasis areas), 46 - emphasis areas 5, 6, and 7, 76 - emphasis areas 5, 6, and 7, 85 - emphasis areas 5 and 6, 99 - emphasis areas 5 and 6.

A lop and scatter prescription does not remove fuels from treated areas. It prescribes changing the size and arrangement of the fuels. Lop and scatter prescriptions usually deal with activity generated fuels as a result of tree removal (tree tops and branches), however it can also apply to brush and standing ladder fuels. The purpose of a lop and scatter prescription, by changing the arrangement and size of fuels, is to take the fuels to a condition that allows the material to break down more rapidly.

Fire/Fuels Treatment Methods

Underburning
Units: 34, 38, 39, 46, 47, 61, 73, 76, 89, 90, 100, 163, 282 (all emphasis areas).

Underburning is a generalized term used when applying prescribed fire to large areas and is typically the treatment method for a surface fire prescription. Underburning targets surface fuels, some understory, and, in rare cases, larger trees. Surface fuels are the primary agent of fire spread. The objective is to apply controlled fire under optimum conditions where the treatment can modify fuel conditions to effectively reduce fire behavior and the corresponding intensity of a future wildfire. Within some areas proposed for burning, the goal of the treatment may be to consume a significant portion of the existing surface fuels that could cause high wildfire intensities, and/or the consume understory vegetation (ladder fuels) in order to reduce future fire severity and to create conditions that allow for future prescribed underburning opportunities. In other areas, underburning is used to create new growth of native shrub species and forage opportunities for wildlife. Underburning most closely mimics low-intensity fire that would occur in an active fire regime. Underburning, especially on south and west facing slopes, is typically conducted under spring-like conditions. A more mosaic burn pattern is created by underburning in spring-like conditions as compared to fall-like conditions; with some areas minimally burned and overall less fuel consumption. For the Sagehen Project proposal, underburning would be applied on a unit-wide basis, in other words, where underburning is proposed it would be conducted across the entire treatment unit and across all subunits (emphasis areas) within that treatment unit.

Hand Piling and Burning
Units: 61, 80, 91, 98, 100, 282 (all emphasis areas), 99 - emphasis areas 1, 2, and 4.

After a hand or mechanical thin, residual activity fuels and some naturally occurring fuels are piled by hand into burn piles. Hand piles of fuels typically are burned under fall-like conditions, in winter months, or during periods of low fire danger.

Grapple Piling and Burning
Units: 33, 35, 36, 156, 163, 213 (all emphasis areas).

After a mechanical thin, residual activity fuels and some naturally occurring fuels are piled by a grapple piler into burn piles. A grapple piler is typically an excavator that can pick up fuels from the ground surface, carry the material suspended from the ground, and place it in a pile for burning. This equipment would operate on slopes generally less than 25 percent. Short pitches less than 150 feet long and up to 30 percent in slope would also be included in treatments using ground based equipment. Grapple piles of fuels typically are burned under fall-like conditions, in winter months, or during periods of low fire danger.

Mastication

Units: 87 (all emphasis areas), 46 - emphasis areas 5, 6, and 7, 76 - emphasis areas 5, 6, and 7, 85 - emphasis areas 5 and 6, 99 - emphasis areas 5 and 6.

As stated above, a masticator is a low ground pressure piece of equipment that “chews” up brush, small understory trees and downed woody fuels. Mastication does not actually remove wildland fuels from the treated area, but changes the size, continuity, and arrangement of the fuels, leading to an acceleration of decomposition rates of processed material and producing a desired change in fire behavior. Mastication changes a vertical large piece of fuel (i.e. a standing tree) into many smaller pieces of horizontal fuel. This is termed “rearranging” the fuels to a condition that allows the material to decompose more rapidly and/or burn more quickly with less intensity (small pieces). It would also be more difficult to ignite this material (horizontal, on the ground with less air flow). Mastication can be a mechanized method of implementing a lop and scatter fire/fuels prescription. This equipment would operate on slopes generally less than 25 percent. Short pitches less than 150 feet long and up to 30 percent in slope would also be included in treatments using ground based equipment. Mastication is also a Silvicultural Treatment Method – see above.

ALTERNATIVE 2 (NO ACTION)

Under the No Action Alternative, none of the activities proposed under Alternative 1 or Alternative 3 would be implemented. The No Action Alternative would not preclude activities that have already been approved in this area or those being planned as separate projects.

ALTERNATIVE 3 (NON-COMMERCIAL FUNDING)

Alternative 3 was developed in accordance with Eastern District Court Judge England's November 4, 2009 order for Case 2:05-cv-00205-MCE-GGH. The order requires the Forest Service to analyze a non-commercial funding alternative in detail for all new fuel reduction projects not already evaluated and approved as of November 4, 2009. To develop this alternative, the proposed treatment areas were revisited to determine (a) if a beneficial fuel treatment was possible and (b) what those treatments would be.

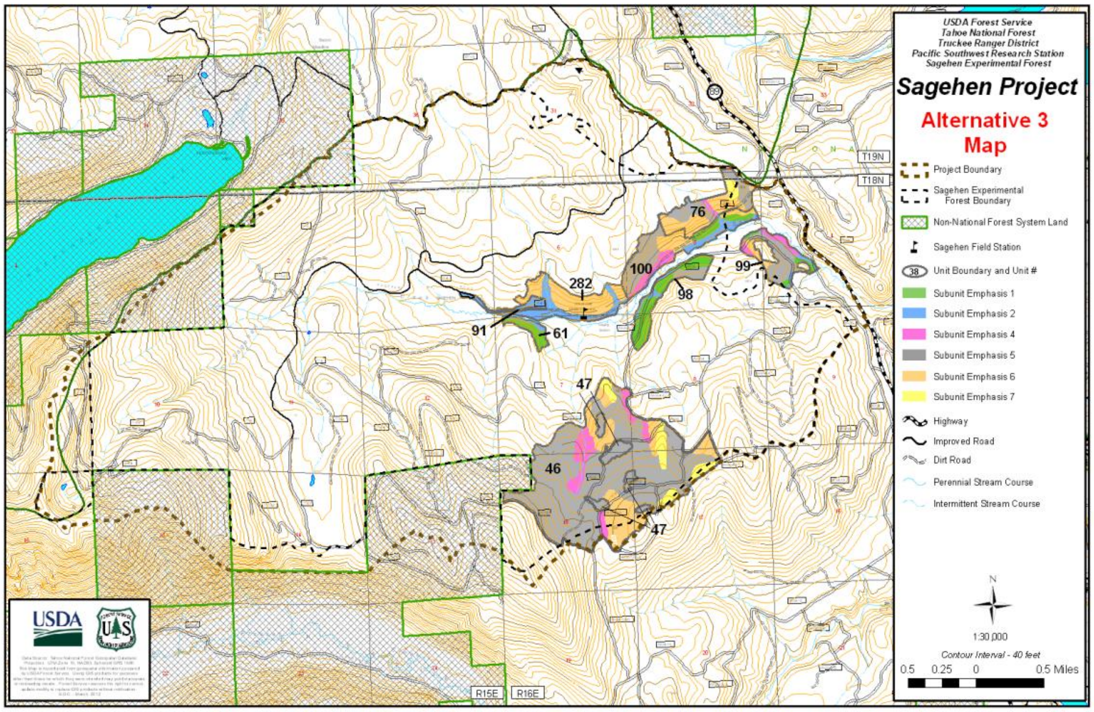

Figure 2: Alternative 3 Map

A total of 1,166 acres were considered for non-commercial treatments. All units were not considered to be treated under this alternative because the cost would have been too great. Therefore, in order to reduce implementation costs to around one million dollars, the most critical units were chosen for treatment (including fuels only prescriptions on all units would have cost close to twice that amount). The treatments identified only partially meet the purpose and need by addressing hazardous surface and ladder fuels. The following actions are proposed under Alternative 3 (Table 6) and are displayed on Figure 2. Note that while emphasis areas are displayed here, there are no project goals specifically tied to each emphasis area in Alternative 3 like there are in Alternative 1. The emphasis areas are displayed solely to provide a consistent way to compare the alternatives.

Table 6: Summary of Alternative 3 by Treatment Area

Unit	**Total Acres**	**Emphasis Area**	**Unit Emphasis Area Acres**	**Silvicultural Rx – *see Order of Prescription Application section above***	**Silvicultural Treatment Method**	**Fire/Fuels Rx**	**Fire/Fuels Treatment Method**
33	118	1	4	No Treatment	N/A	No Treatment	N/A
		4	30				
		5	28				
		6	56				

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Silvicultural Rx – *see Order of Prescription Application section above*	Silvicultural Treatment Method	Fire/Fuels Rx	Fire/Fuels Treatment Method
34	68	5	16	No Treatment	N/A	No Treatment	N/A
		6	47				
		7	5				
35	64	1	8	No Treatment	N/A	No Treatment	N/A
		4	6				
		5	7				
		6	37				
		7	6				
36	101	4	18	No Treatment	N/A	No Treatment	N/A
		5	13				
		6	56				
		7	14				
38	210	1	67	No Treatment	N/A	No Treatment	N/A
		4	7				
		5	86				
		7	50				
39	32	5	32	No Treatment	N/A	No Treatment	N/A
46	621	4	47	No Treatment	N/A	Surface Fire Rx	Underburn
		5	431	Plantation Thin	Mechanical Mastication	Lop & Scatter Surface Fire Rx	Mastication Underburn
		6	105				
		7	38				
47	33	5	33	No Treatment	N/A	Surface Fire Rx	Underburn
61	20	1	15	Suppressed Cut	Hand Thinning	Pile Burn Rx Surface Fire	Hand Pile Pile Burn
		2	5				

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Silvicultural Rx – *see Order of Prescription Application section above*	Silvicultural Treatment Method	Fire/Fuels Rx	Fire/Fuels Treatment Method
						Rx	Underburn
73	144	4	6	No Treatment	N/A	No Treatment	N/A
		5	107				
		6	27				
		7	4				
76	91	4	4	No Treatment	N/A	Surface Fire Rx	Underburn
		5	37	Plantation Thin	Mechanical Mastication	Lop & Scatter Surface Fire Rx	Mastication Underburn
		6	42				
		7	8				
80	5	8	5	No Treatment	N/A	No Treatment	N/A
85	64	5	10	No Treatment	N/A	No Treatment	N/A
		6	53				
		8	1	No Treatment	N/A	No Treatment	N/A
87	207	5	67	No Treatment	N/A	No Treatment	N/A
		6	130				
		7	10				
89	34	4	6	No Treatment	N/A	No Treatment	N/A
		6	28				
90	40	6	40	No Treatment	N/A	No Treatment	N/A
91	9	2	9	Suppressed Cut	Hand Thinning	Pile Burn Rx	Hand Pile Pile Burn
98	63	1	43	Suppressed Cut	Hand Thinning	Pile Burn Rx	Hand Pile Pile Burn
		2	9				
		5	11				

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Silvicultural Rx – *see Order of Prescription Application section above*	Silvicultural Treatment Method	Fire/Fuels Rx	Fire/Fuels Treatment Method
99	67	1	7	Suppressed Cut	Hand Thinning	Pile Burn Rx	Hand Pile Pile Burn
		2	4				
		4	11				
		5	37	Plantation Thin	Mechanical Mastication	Lop & Scatter	Mastication
		6	8				
100	120	1	14	Suppressed Cut	Hand Thinning	Pile Burn Rx Surface Fire Rx	Hand Pile Pile Burn Underburn
		2	19				
		4	17				
		5	46				
		6	24				
156	84	1	84	No Treatment	N/A	No Treatment	N/A
163	82	1	29	No Treatment	N/A	No Treatment	N/A
		5	49				
		7	4				
213	268	1	182	No Treatment	N/A	No Treatment	N/A
		2	11				
		4	21				
		5	18				
		6	25				
		7	11				
282	108	2	46	Suppressed Cut	Hand Thinning	Pile Burn Rx Surface Fire Rx	Hand Pile Pile Burn Underburn
		6	62				

VI. EXISTING ENVIRONMENT, EFFECTS OF THE PROPOSED ACTION AND ALTERNATIVES, AND DETERMINATION

Existing Environment

The Sagehen Project Area is comprised of mature, second growth conifer forests and 40-50 year old Jeffrey pine plantations. Elevations range from 6,000 to 7,500 feet, and slopes range from near flat to very steep. Forest conditions in the Sagehen Project Area have been significantly altered by human activities since the early 1870s.

From the 1870s through 1890s, the Banner Mill sawmill was located within the Basin where sawtimber was cut and milled. The majority of the remaining trees were cut removed by contractors for firewood. After the Banner Mill closed, the Sierra Nevada Wood and Lumber Company removed sawtimber from the remaining sections in the Basin. A mainline railroad grade was pushed north through the Sagehen Basin. Harvesting by this company extended up in elevation to much of the red fir sawtimber in Section 10, Township 18N, Range 15E. By 1931, the Company had begun to harvest the sawtimber within the Basin with early tractor based logging systems. From the 1890s through 1936, most if not all of the remaining saw (merchantable) timber was removed from the Basin. What remained was a scattering of second growth trees that grew in after the 1870s-1890s logging and the non-merchantable trees left after sawtimber removal from the 1890s-1936 (Knowles, 1942, Myrick, 1992, Wilson, 1992). The Forest Service purchased the land in 1936. Trees remaining in 1936 became some of the legacy trees seen in the Basin today. Since 1936, the Forest Service conducted some logging and salvage operations, most notably post-fire salvage logging in the 1960s following the 1960 Donner Ridge Fire, the Golden Timber Sale in 1988, the Sagehen Salvage Sale in 1990, and the Sagehen and Spring Chicken Fuel Breaks in 1998 and 2002 respectively.

Since the early 1900s, fire suppression policy has excluded most wildfire from the area. The mean historic fire return interval ranged from 10 to 30 years and the current fire return interval ranges from 50 to 95+ years. Generally, the stands that were not affected by stand replacing fire in the last century, but are a consequence of fire suppression, historic logging and some recent vegetation management will be referred to as “Natural Developed Forests” (NDF).

In 1926, the Independence Fire burned 2,653 acres within the Sagehen Basin. Reforestation efforts in the 1970s resulted in a 207 acre mostly Jeffrey pine plantation. In 1960, the Donner Ridge Fire burned 44,812 acres; approximately 1,600 of those were within the Sagehen Basin. Reforestation efforts after the fire resulted in approximately 1,140 acres of plantations consisting mostly of Jeffrey pine within the Sagehen Basin, of which 519 acres are under contract for treatment, while the remaining 621 acres are not. In addition to plantations, several hundred acres were affected by higher severity fire where only a few remnant over story trees survived from the Donner Ridge Fire and that naturally reseeded.

The Sagehen Project is described in terms of project units, project area, and wildlife analysis area. The project units include all areas where proposed treatments will occur (2,652 acres in Alternative 1 and 1,132 acres in Alternative 3). The project area encompasses the project units and is useful in describing general aspects of the project. The project area is sometimes also referred to as the Sagehen Basin or the Basin. The direct and indirect effects are analyzed within the alternative treatment units.

Species and Habitats Not Affected by Sagehen Project

No effects will result from implementation of the Sagehen Project to species that do not occur or do not have suitable habitat within the analysis area. Species presented below (Table 7 do not occur or have suitable habitat within the analysis area, will not be affected by implementation of either of the action alternatives, and are not analyzed further. A rationale for each determination is also given (Table X).

Table 7. Species eliminated from further analysis for the Sagehen Project due to lack of suitable habitat, outside the known range of the species, or project will have No Affect to species or habitat within the wildlife analysis area.

SPECIES	SPECIES STATUS[1]	EFFECTS DETERMINATION[2]	RATIONALE FOR DETERMINATION
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)	T	No Effect	Analysis area outside the range for this species (above 3,000 feet)
Fisher (*Martes pennanti*)	FSS, C	No Effect	Analysis area outside the known distributional range for this species (above 5,000 feet)
Sierra Nevada red fox	FSS	No Effect	Outside the known distributional range for this species.
Greater sandhill crane (Grus	FSS	No Effect	Nearest breeding population outside of analysis area.
Western red bat, Townsend's big-eared bat, pallid bat	FSS	No Effect	Outside the known distributional range and/or no suitable habitat for these species

[1]Forest Service Sensitive (FSS), U.S. Fish and Wildlife Service Endangered (E), Threatened (T), Proposed (P), or Candidate (C) species.

[2]Effects determinations for the two action alternatives (Alternative 1 and Alternative 3)

SPECIES-SPECIFIC ANALYSIS AND DETERMINATION

This section discusses each species in three parts, A) Existing Environment, B) Effects of the Proposed Action and Alternatives including Project Design Standards, and C) Conclusion and Determination.

Section A describes the existing environment including species life history, status, and relevant information. Further detail can be found in the Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement and Record of Decision (SNFPA 2001; USDA Forest Service 2001) and Sierra Nevada Forest Plan Amendment Record of Decision and Final Supplemental Environmental Impact Statement and Record of Decision (SNFPA 2004; USDA Forest Service 2004).

Section B addresses the effects of the proposed project to the various species including project design standards and required mitigation measures. Effects are described as direct, indirect or cumulative. Direct effects as described in this evaluation refer to mortality or disturbance that result in flushing, displacement or harassment of the animal. Indirect effects refer to modification of habitat and/or effects to prey species. Cumulative effects represent "The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (National Environmental Policy Act 1986). If the cumulative effects involve a federally listed species, the definition expands to address "those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation" (Endangered Species Act, 1973 as amended).

Section C provides a summary of supporting conclusions and the statement of determination for each species based upon relevant information provided in Sections A & B.

Analysis Methods and Tools

The wildlife analysis for this project used the latest science, data, analytical tools, and various resource information, including the Forest Service Natural Resource Management (NRM) Wildlife application database, California Natural Diversity Database (CNDDB), Forest Service vegetation maps, ESRI Geographic Information System (GIS) ArcMap 10, Geospatial Interface (GI) end user tools (GI Client), and GI Project Analysis Tool (GI Registration Tool). Customized GI queries were used to facilitate efficient retrieval of wildlife and habitat data, allow streamlined analysis, and provide repeatable and consistent results.

Assistance from Regional Office NRM – NRIS Natural Resource Information Management staff was utilized to develop and write all the customized habitat queries for marten, goshawk, spotted owl, and Management Indicator Species, which greatly facilitated efficient and streamlined analysis for this report and for the MIS report. Tahoe NF GIS staff provided invaluable assistance and support at multiple levels of the analysis, including preparing GIS layers for proposed treatments, Existing Vegetation maps, and GIS layers and activity summaries of past, present, and reasonably foreseeable future projects for the cumulative effects analysis. Project and species habitat maps were prepared by RO NRM – NRIS staff and Tahoe NF GIS staff.

Metrics for Analyzing Direct, Indirect, and Cumulative Effects

Direct Effects – Direct effects are potential impacts that could affect the distribution, abundance, and reproductive status of wildlife species through direct disturbance associated with proposed activities within or adjacent to the project treatment units. Known species distribution and reproductive status were identified for the analysis area using the Forest Service NRIS database, CNDDB, Tahoe NF GIS layers, and other relevant data collected by researchers and other individuals. Species locations, reproductive status, and proximity to project alternative activities are described for determining potential direct effects.

Indirect Effects - Habitat Quality and Quantity

CWHR Type, Size, and Canopy Cover

Indirect effects to terrestrial wildlife habitat quality and quantity were analyzed by using current Forest Service vegetation maps with attributes of the California Wildlife Habitat Relationships (CWHR) vegetation classification system. The CWHR habitat types and structural classes were designed to correlate with forest inventory data used by the USDA Forest Service, specifically relative to the project alternatives potential to affect tree size and canopy cover density classes. The CWHR system was developed to categorize major vegetative complexes at a scale sufficient to predict wildlife-habitat relationships, and has been a widely accepted approach for describing and analyzing changes to wildlife habitats at the project and broader landscape scales.

The Forest Service Forest Vegetation Simulator (FVS) model was used to predict post-treatment tree size class and canopy cover density. Table 8 displays the current acres of CWHR types, size class, and density within the wildlife analysis area by ownership.

Table 8. CWHR Types, Size Class, and Canopy Cover within the Wildlife Analysis Area by Ownership

CWHR Type	Size Class	Canopy Cover	Forest Service Acres	Private Acres
ADS			86	0
BAR			250.3	204.39
BBR			637.49	28.52
EPN	1	M	6.3	0
EPN	1	S	5.35	0
EPN	1	X	96.31	0
EPN	2	D	20.17	0
EPN	2	M	22.12	0
EPN	2	P	100.3	0
EPN	2	S	242.78	4.72
EPN	3	D	309.05	
EPN	3	M	175.12	2.73
EPN	3	P	319.68	0
EPN	3	S	232.78	0
EPN	4	D	826.91	8.98
EPN	4	M	888.2	71.26
EPN	4	P	1492.49	80.68
EPN	4	S	757.82	57.41
EPN	5	D	5.01	0
EPN	5	M	64.79	8.63
EPN	5	P	70.89	0.1
EPN	5	S	15.91	0
EPN	6	D	13.61	0
JPN	1	S	3.85	0
JPN	1	X	17.04	0
JPN	2	D	9.55	0
JPN	2	M	12.79	0
JPN	2	P	57.33	0
JPN	2	S	125.77	0
JPN	3	D	256.04	0
JPN	3	M	374.41	1.04
JPN	3	P	82.2	0
JPN	3	S	126.08	4.19
JPN	4	D	1426.49	9.97
JPN	4	M	1072.37	293.34
JPN	4	P	1184.07	156.02

JPN	4	S	403.54	75.04
JPN	5	D	0.72	34.11
JPN	5	M	72.5	39.7
JPN	5	P	39.7	18.52
JPN	5	S	12.75	0
LAC			4.27	703.48
LPN	3	D	182.1	0
LPN	3	M	32.91	0
LPN	3	P	59.9	0
LPN	3	S	19.98	3.04
LPN	4	D	488.73	10.59
LPN	4	M	187.13	51.85
LPN	4	P	170.18	47.75
LPN	4	S	77.01	4.56
LPN	5	D	1.65	0
LPN	5	M	0	54
LPN	5	P	20.78	27.46
LPN	5	S	0	6.16
LPN	6	D	3.62	2.57
LSG	1		3.32	0
MCP			1762.24	522.46
MRI	2	M	0	87.13
MRI	3	P	0	5.24
MRI	4	D	4.71	3.22
MRI	4	M	10.28	1.2
MRI	4	P	4.46	16.46
MRI			262.53	155.7
PGS			159.84	17.25
RFR	2	M	8.61	0
RFR	2	P	9.46	2.22
RFR	2	S	0	1.8
RFR	3	D	19.2	0
RFR	3	P	21.26	142.82
RFR	3	S	26.04	8.04
RFR	4	D	536.23	79.77
RFR	4	M	565.14	292.98
RFR	4	P	384.73	440.01
RFR	4	S	214.84	154.95
RFR	5	D	16.63	6.58
RFR	5	M	152.71	103.73
RFR	5	P	37.34	97.28
RFR	5	S		7.27

RFR	6	D	63.08	13.4
SCN	4	M	54.75	25.31
SCN	4	P	7.3	54.27
SCN	4	S	13.65	13.06
SCN	5	M	10.31	
SCN	5	P	16.46	8.29
SGB			74.13	5.06
SMC	1	S	0.9	29.38
SMC	3	D	14	0
SMC	3	M	17.38	0
SMC	3	P	29.17	0.45
SMC	3	S	62.1	16.55
SMC	4	D	1481	16.92
SMC	4	M	615.27	128.1
SMC	4	P	373.78	40.86
SMC	4	S	88.39	9.52
SMC	5	D	5.32	45.28
SMC	5	M	14.75	28.42
SMC	5	P	125.2	107.12
SMC	5	S	24.89	61.31
SMC	6	D	2.11	7.02
URB			3.77	1.29
WFR	2	D	16.25	0
WFR	2	S	27.19	0
WFR	3	M	22.05	0
WFR	3	P	20.26	11.1
WFR	3	S	32.56	75.51
WFR	4	D	503.46	283.67
WFR	4	M	454.79	449.52
WFR	4	P	244.48	507.49
WFR	4	S	121.26	183.13
WFR	5	D	74.23	73.85
WFR	5	M	33.63	368.34
WFR	5	P	5.71	24.78
WFR	5	S	11.95	34.54
WFR	6	D	56.3	13.52
WTM			150.37	436.42
			22,236.6	7,230.4

*ADS (alpine dwarf-shrub), ASP (aspen), BAR (barren), BBR (bitterbrush), EPN (eastside pine), JPN (Jeffrey pine), LAC (lacustrine), LPN (lodgepole pine), LSG (low sage), MCP (montane chaparral), MRI (montane riparian), PGS (perennial grassland), RFR (red fir), SGB (sagebrush), SMC (Sierran mixed conifer), SCN (subalpine conifer), URB (urban), WTM (wet meadow), WFR (white fir)

**Tree Canopy*:* Trees provide cover and food for California's terrestrial wildlife. The amount and extent of tree canopies are used in the CWHR system to help predict which wildlife species may be supported by these ecosystems. This table outlines the tree canopy cover classes used in CWHR.

CWHR Tree Canopy Cover Classes

Tree Canopy	Description (% Canopy Cover)
S	10 to 24%
P	25 to 39%
M	40 to 59%
D	60 to 100%
	Not Determined

***Tree Size: Tree size also helps determine which wildlife species may be supported by a particular ecosystem. This table outlines the tree size classes used in CWHR.

CWHR Tree Size Class Descriptions

CWHR Size	Description	Diameter at Breast Height
1	Seedling	Less Than 1 inch
2	Sapling	1 to 6 inches
3	Pole	6 to 11 inches
4	Small Tree	11 to 24 inches
5	Medium/Large	Tree Greater Than 24 inches
6	Multi Layered	Size 5 Over Size 4 Or 3; Total Tree Crown Closure Greater Than 60%

Habitat Quantity and Quality **-** While the CWHR system provides a useful and relative measure to track changes from treatments to habitat quantity, it is limited in its ability to describe habitat quality, particularly in terms of habitat diversity and structural complexity, particularly where understory and structural complexity can be reduced or eliminated from fuels treatments such as underburning. However, it may be useful in tracking broader landscape changes to tree size and canopy cover. For example, a unit may be comprised of trees with an average canopy cover of 58%, and post-treatment may result in a residual canopy cover of 45% where the CWHR size (M) would remain unchanged. However, this treatment results in reduced canopy cover as well as a more simplified or less complex understory composition and structure that may affect the distribution of small mammals and songbirds. Therefore, a narrative summary is also used to provide a description of post project effects of the proposed activities on habitat diversity and structural complexity, forest resiliency and climate change, and forest connectivity and fragmentation.

Snags and Down Logs - Snags and down logs are important habitat components particularly late-seral associated species such as the Pacific marten, Northern goshawk and the California spotted owl for nesting, roosting, and denning. The FVS model was used to predict the amount of snags and down logs that would be affected by project alternatives. However, the FVS model does not account the project's Decadent Feature Enhancement treatments whereby snags would be created through partial girdling and topping trees to create short snags for roosting and denning. Therefore, both a quantitative and qualitative description of snags and down logs is appropriate for analyzing impacts from project alternatives.

Effects Common to All Wildlife Species

No Action Alternative (Alternative 2)

Direct Effects: There would be no direct effects to Sensitive wildlife species, since none of the activities proposed for the action alternatives would occur.

Indirect Effects:

Past large uncharacteristically severe wildfires (specifically the Donner Ridge and Independence), combined with reforestation efforts 50 years ago, have resulted in the extensive Jeffrey and ponderosa pine plantations that currently occupy the southeastern, northeastern, and northwestern areas of the Sagehen Basin. Dense second growth conifer stands occupy much of the remainder of the Basin and fire has been excluded from these natural stands for decades. Past fires, reforestation, timber harvesting, and fire exclusion have combined to create today's simplified, relatively homogenous structure of the plantations and many of the Basin's forest stands.

The structure and tree species composition of the plantations and many of the Basin's forest stands have made them vulnerable to a host of mortality factors, including drought stress, bark beetle outbreaks, disease, and the over-arching ramifications of climate change. Excessive tree mortality can have significant and long-term effects on forest structure and composition, and these conditions can exacerbate the threat of severe fire. Climate change is anticipated to aggravate these stressors.

The No Action Alternative would not change the quality or quantity of wildlife habitat in the short term, nor the distribution of seral stages that are currently present. If no action occurred within the Sagehen Basin, there would be an increase in the susceptibility of wildlife habitat loss to disturbances such as fire, insect, and disease outbreaks over time as fuel loadings continue to increase due to conifer mortality and increasing stand densities. If a stand-replacing fire were to occur in the next 25 years, it would likely replace mid- to late-successional habitat that is presently available to late-successional-associated sensitive species—the California spotted owl, Northern goshawk, Pacific marten—with early-successional shrub habitat, which would be detrimental to the majority of sensitive species and other species of concern in the project area. Early successional associated species would benefit from fire, by improving foraging opportunities for shrub-dependent species over the next 10 to 25 years. This could indirectly benefit species such as the wolverine and Sierra Nevada red fox, by improving habitat for prey species by creating browse for deer and forage for small mammals

Effects Common to Each of the Action Alternatives (1 and 3)

Direct Effects: Direct effects to wildlife occur from disturbing, injuring or killing individuals. Noise from operating motorized equipment during project implementation, or smoke from prescribed burning, has the potential to directly affect wildlife by displacing individual animals from the vicinity of project treatment units. The proposed project cover a total of 2,654 acres (9%) out of the 29,467-acre analysis area that include a variety of types of activities—variable thinning, legacy tree treatment, dense cover areas, early seral openings, underburning, suppressed cutting, mastication, and snag creation. Individual projects are typically implemented over a five to ten-year period, which spreads out disturbances both spatially and temporally within any one location. This further limits the area affected by disturbances of the analysis area in any individual year. Noise disturbing effects are temporary, lasting several months during the year when they are implemented. If needed, limited operating periods are included in the management requirements to protect California spotted owl and northern goshawks or other TESP species that have active nests or roosts within 0.25 miles of project-related noise disturbances, to reduce the potential for disrupting breeding and reproduction in the project area as follows:

TES species: If any Federally threatened, endangered, proposed, or Forest Service sensitive species previously unknown in the project area are detected or found nesting within 0.25 miles of project activities, appropriate mitigation measures would be implemented based on input from the aquatics biologist, botanist, and/or wildlife biologist. Measures can include, but are not limited to, flagging and avoiding a plant site, implementing a species specific LOP, or designating a protected activity center.

Specific LOPs are described for spotted owl and goshawk under the species specific section.

Indirect Effects: Indirect effects to wildlife may occur from altering the quantity or quality of habitat.

In both of the action alternatives the fuels reduction proposals that include removing trees less than 10" dbh and shrubs using a variety of methods--hand cutting, piling and burning, mastication, and underburning with prescribed fire.

The fuels treatments would reduce the shrub component immediately post-treatment, but within five years, shrubs would re-sprout. Newly sprouting shrubs provide high quality browse for deer, and shrub seeds and herbaceous vegetation provide food and shelter for rodents such as woodrats, mice and squirrels, which are prey species that support numerous sensitive species such as spotted owls, goshawk, marten, fisher, and the Sierra Nevada red fox.

Proposals to hand cut, pile and burn smaller diameter trees, masticate under-story vegetation, and prescribed burn, are not expected to change California Wildlife Habitat Relationships (CWHR) classification types. Studies have shown that small mammals (woodrats, deer mice) quickly repopulate burned areas, provided there are nearby unburned understory vegetation to provide source populations. Masticating and burning may reduce small mammal populations in the first year or two, but populations are expected to readily recover thereafter. Therefore, effects to small mammal populations are limited in scope, both spatially and temporally. Implementing projects using a variety of techniques (masticating, prescribed fire, hand cutting, thinning) varies the types of effects spatially throughout the watershed, and implementing projects with appropriated funding distributes these effects temporally, because not all projects in the watershed are fully funded in any given year.

The action alternatives would develop forest stands that would be more resilient to the array of threats. These efforts will enhance forest heterogeneity at both the stand- and landscape-scale; reducing stand densities in certain locations; and modifying tree species composition, for example, favoring more fire resilient pines on south facing slopes, could address these potential sources of mortality. Reducing stand densities would result in less competition for soil moisture resources and light, which would help accelerate the development of stands comprised of larger trees. By creating a more heterogeneous landscape, remaining trees and stands would be better able to cope with drought stress, insect infestation, and disease outbreaks.

Snags and Downed Logs (California Spotted Owl, Goshawk, and Pacific Marten)

Large snags and downed logs provide nesting, resting, and sheltering structures for spotted owls, goshawk, and forest carnivore species and their prey, including cavity-nesting birds and small mammals. Downed logs provide nutrient cycling, maintain soil moisture and provide microclimates for fungi; and fungi are an important food source for small rodents which are the primary prey for many wildlife species. For the action alternatives, the existing snags would be retained, except for snags that pose a hazard or snags that need to be removed for operability.

Alternatives 1 and 3 propose underburning within 643 acres (15%) of mid-seral closed-canopy forests. Prescribed burning is only proposed where existing conditions indicate a high probability of successfully retaining post-treatment stand conditions that are desirable for older forests. Burning prescriptions are developed to minimize the loss of large trees, large downed logs, and large standing snags where practical and where firefighter safety is not compromised. Prescribed burning as proposed would affect only 30% of the treatment units in a manner which would create a mosaic leaving patches of burned and unburned vegetation and woody debris. Some existing snags and down logs would be consumed by the fire, and some trees would likely die from additional stresses from burning. Dead trees would be recruited as snags in the future, and subsequently down logs.

Stephens and Moghaddas (2005) found that use of prescribed fire increased the density of snags greater than 15 cm DBH, and did not significantly alter coarse woody debris in decay classes 1 and 2. In the same study by Stephens and Moghaddas (2005), fire reduced coarse woody debris in decay classes 3 and 4. The use of prescribed fire will increase the forest resiliency to catastrophic loss in a wildfire, and it re-introduces fire back into the system as a dynamic process.

The Forest Vegetation Simulator (FVS) model was used to project snags per acre for snags at 15-30 inch dbh and >30 inch dbh for current conditions, predicted at 30 years, and predicted at 50 years after present for the alternatives by unit and emphasis area from (Table 9). The number of partial girdled trees inside and outside Dense Cover Areas (DCAs) and the number of short snags created for the alternatives is also displayed in Table 9.

In general, the Forest Vegetation Simulator model indicates that Alternative 1, the Proposed Action, would result in fewer snags per acre compared to both Alternatives 2 and 3, since thinning would remove some recruitment snags. Alternative 2 would result in more snags compared to Alternative 3, since some units would be treated. For example, Unit 36 currently has 6.6 snags/acre that are 15-30 inch dbh and 1.3 snags/acre that are >30 inch dbh. Snag estimates for this unit 30 years post-treatment are projected to be 2.1/acre in the 15-30 inch dbh size class and 0.9/acre in the >30 inch dbh size for Alternative 1. At 30 years, snag densities in Unit 36 would be 15 snags/acre and 1 snag/acre, respectively under Alternatives 2 (no action) and Alternative 3 (no treatments would be conducted in Unit 36 under Alternative 3. However, the Forest Vegetation Simulator model does not account for snags developed through short snag creation or partially girdling under Alternative 1. Alternative 1 proposes to partially girdle 21 trees and create 9 short snags in Unit 36 specifically to enhance snag habitat for wildlife, including marten, spotted owl, and goshawk. This would increase projected snag densities by another 0.3 snags/acre for a short term benefit to species requiring snags within Unit 36.

Table 9. Current Snags/Acre, Projected Snags/Acre at 30 and 50 years Post-Treatment, Number of Partial Girdled Trees, and # Short Snags Created by Unit and Emphasis Area

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Current (2012) Snags/Acre 15-30” dbh	Current (2012) Snag/Acre >30”dbh	Projected (2042) Snags/Acre 15-30”dbh	Projected (2042) Snags/Acre >30”dbh	Projected (2062) Snags/Acre 15-30”dbh	Projected (2062) Snags/Acre >30”dbh	# of Partial Girdled Trees Created outside DCA	# of Partial Girdled Trees Created inside DCA	# of Short Snags Created
Alternative 1												
33	118	1	4	1.64	0	3.37	.05	6.66	.25	7	1	2
		4	30	1.64	0	1.76	.03	6.03	.23	0	0	6
		5	28	1.64	0	1.72	.03	3.93	.16	36	2	4
		6	56	1.64	0	1.6	.03	2.58	.12	0	2	2
Average Snags/Acre				1.64	0	2.11	0.04	4.8	0.19	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
33	118	1	4	1.64	0	14.85	.12	17.49	.44	0	0	0
		4	30							0	0	0
		5	28							0	0	0
		6	56							0	0	0
Alternative 1												
34	68	5	16	1.18	0	1.92	.05	5.08	.18	0	0	3
		6	47	1.18	0	1.72	.06	2.53	.12	0	0	2
		7	5	1.18	0	1.72	.06	2.53	.12	0	0	0
Average Snags/Acre				1.18	0	1.79	0.06	3.38	0.14	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
34	68	5	16	1.18	0	10.59	.09	15	.36	0	0	0
		6	47							0	0	0

Table 9. Current Snags/Acre, Projected Snags/Acre at 30 and 50 years Post-Treatment, Number of Partial Girdled Trees, and # Short Snags Created by Unit and Emphasis Area

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Current (2012) Snags/Acre 15-30" dbh	Current (2012) Snag/Acre >30"dbh	Projected (2042) Snags/Acre 15-30"dbh	Projected (2042) Snags/Acre >30"dbh	Projected (2062) Snags/Acre 15-30"dbh	Projected (2062) Snags/Acre >30"dbh	# of Partial Girdled Trees Created outside DCA	# of Partial Girdled Trees Created inside DCA	# of Short Snags Created
		7	5							0	0	0
Alternative 1												
35	64	1	8	2.12	1.26	1.82	.93	2.77	.75	6	1	2
		4	6	2.12	1.26	1.52	.94	1.19	.78	0	0	1
		5	7	2.12	1.26	1.77	.93	2.34	.74	7	1	1
		6	37	2.12	1.26	1.77	.93	2.34	.74	0	0	1
		7	6	2.12	1.26	1.63	.94	2.14	.77	0	0	0
Average Snags/Acre				2.12	1.26	1.7	0.93	2.16	0.76	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
35	64	1	8	2.12	1.26	9.99	1.22	13.51	1.37	0	0	0
		4	6							0	0	0
		5	7							0	0	0
		6	37							0	0	0
		7	6							0	0	0
Alternative 1												
36	101	4	18	6.63	1.26	2.32	.93	6.23	.81	0	0	6
		5	13	6.63	1.26	2.32	.93	6.23	.81	20	1	2
		6	56	6.63	1.26	1.82	.92	4.46	.79	0	0	1
		7	14	6.63	1.26	1.83	.93	2.2	.73	0	0	0
Average Snags/Acre				6.63	1.26	2.07	0.93	4.78	0.79	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
36	101	4	18	6.63	1.26	14.89	.98	19.28	.94	0	0	0

Table 9. Current Snags/Acre, Projected Snags/Acre at 30 and 50 years Post-Treatment, Number of Partial Girdled Trees, and # Short Snags Created by Unit and Emphasis Area

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Current (2012) Snags/Acre 15-30" dbh	Current (2012) Snag/Acre >30"dbh	Projected (2042) Snags/Acre 15-30"dbh	Projected (2042) Snags/Acre >30"dbh	Projected (2062) Snags/Acre 15-30"dbh	Projected (2062) Snags/Acre >30"dbh	# of Partial Girdled Trees Created outside DCA	# of Partial Girdled Trees Created inside DCA	# of Short Snags Created
		5	13							0	0	0
		6	56							0	0	0
		7	14							0	0	0
Alternative 1												
38	210	1	67	3.53	0	3.35	.06	2.84	.09	0	0	19
		4	7	3.53	0	3.03	.07	3.47	.12	0	0	1
		5	86	3.53	0	2.91	.07	3.27	.13	0	0	9
		7	50	3.53	0	2.81	.07	3.01	.14	0	0	0
Average Snags/Acre				3.53	0	3.03	0.07	3.15	0.12	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
38	210	1	67	3.53	0	7.95	.04	16.02	.24	0	0	0
		4	7							0	0	0
		5	86							0	0	0
		7	50							0	0	0
Alternative 1												
39	32	5	32	4.74	0	6.54	0	12.96	0	0	0	0
Average Snag/Acre				4.74	0	6.54	0	12.96	0	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
39	32	5	32	4.74	0	8.44	0	18.73	0	0	0	0
Alternative 1 & Alternative 3												
46	621	4	47	.38	0	.31	.01	2.81	.01	0	0	0
		5	431	.38	0	.44	0	2.24	0	0	0	0

Table 9. Current Snags/Acre, Projected Snags/Acre at 30 and 50 years Post-Treatment, Number of Partial Girdled Trees, and # Short Snags Created by Unit and Emphasis Area

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Current (2012) Snags/Acre 15-30" dbh	Current (2012) Snag/Acre >30"dbh	Projected (2042) Snags/Acre 15-30"dbh	Projected (2042) Snags/Acre >30"dbh	Projected (2062) Snags/Acre 15-30"dbh	Projected (2062) Snags/Acre >30"dbh	# of Partial Girdled Trees Created outside DCA	# of Partial Girdled Trees Created inside DCA	# of Short Snags Created
		6	105	.38	0	.44	0	2.24	0	0	0	0
		7	38	.38	0	.44	0	2.24	0	0	0	0
			Average Snags/Acre	.38	0	0.41	0	2.38	0	-	-	-
Alternative 2 (no action)												
46	621	4	47	.38	0	.66	0	5.42	0	0	0	0
		5	431							0	0	0
		6	105							0	0	0
		7	38							0	0	0
Alternative 1 & Alternative 3												
47	33	5	33	.38	0	.44	0	2.24	0	0	0	0
			Average Snags/Acre	.38	0	.44	0	2.24	0	-	-	-
Alternative 2 (no action)												
47	33	5	33	.38	0	.66	0	5.42	0	0	0	0
Alternative 1 & Alternative 3												
61	20	1	15	2.82	2.53	6.37	1.83	13.71	1.39	0	0	0
		2	5	2.82	2.53	6.37	1.83	13.71	1.39	0	0	0
			Average Snag/Acre	2.82	2.53	6.37	1.83	13.71	1.39	-	-	-
Alternative 2 (no action)												
61	20	1	15	2.82	2.53	17.23	1.84	16.92	1.38	0	0	0
		2	5							0	0	0
Alternative 1												
73	144	4	6	6.49	.63	3.10	.53	2.62	.45	0	0	2

Table 9. Current Snags/Acre, Projected Snags/Acre at 30 and 50 years Post-Treatment, Number of Partial Girdled Trees, and # Short Snags Created by Unit and Emphasis Area

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Current (2012) Snags/Acre 15-30” dbh	Current (2012) Snag/Acre >30”dbh	Projected (2042) Snags/Acre 15-30”dbh	Projected (2042) Snags/Acre >30”dbh	Projected (2062) Snags/Acre 15-30”dbh	Projected (2062) Snags/Acre >30”dbh	# of Partial Girdled Trees Created outside DCA	# of Partial Girdled Trees Created inside DCA	# of Short Snags Created
		5	107	6.49	.63	3.04	.53	2.56	.46	0	0	16
		6	27	6.49	.63	2.96	.53	2.37	.46	0	0	1
		7	4	6.49	.63	2.83	.53	2.22	.47	0	0	0
Average Snags/Acre				6.49	.63	2.98	0.53	2.44	0.46	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
73	144	4	6	6.49	.63	13.19	.60	16.41	.89	0	0	0
		5	107							0	0	0
		6	27							0	0	0
		7	4							0	0	0
Alternative 1 & Alternative 3												
76	91	4	4	.06	1.08	.50	.86	2.55	.68	0	0	0
		5	37	.06	1.08	.52	.86	.86	.66	0	0	0
		6	42	.06	1.08	.52	.86	.86	.66	0	0	0
		7	8	.06	1.08	.52	.86	.86	.66	0	0	0
Average Snags/Acre				.06	1.08	0.52	0.86	1.28	0.67	-	-	-
Alternative 2 (no action)												
76	91	4	4	.06	1.08	1.7	.80	2.79	.63	0	0	0
		5	37							0	0	0
		6	42							0	0	0
		7	8							0	0	0
80	5	8	5	n/a	n/a	n/a	n/a	n/a	n/a	0	0	0
Alternative 1												

Table 9. Current Snags/Acre, Projected Snags/Acre at 30 and 50 years Post-Treatment, Number of Partial Girdled Trees, and # Short Snags Created by Unit and Emphasis Area												
Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Current (2012) Snags/Acre 15-30" dbh	Current (2012) Snag/Acre >30"dbh	Projected (2042) Snags/Acre 15-30"dbh	Projected (2042) Snags/Acre >30"dbh	Projected (2062) Snags/Acre 15-30"dbh	Projected (2062) Snags/Acre >30"dbh	# of Partial Girdled Trees Created outside DCA	# of Partial Girdled Trees Created inside DCA	# of Short Snags Created
		5	10	3.01	0	1.74	.01	2.49	.08	11	1	1
85	64	6	53	3.01	0	1.73	.01	2.57	.08	0	0	2
		8*	1	n/a	n/a	n/a	n/a	n/a	n/a	0	0	0
			Average Snags/Acre	3.01	0	1.51	.01	1.13	.08	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
		5	10							0	0	0
85	64	6	53	3.01	0	6.06	.02	13.08	.19	0	0	0
		8	1							0	0	0
Alternative 1												
		5	67	0	0	.21	0	2.7	0	0	0	0
87	207	6	130	0	0	.21	0	2.7	0	0	0	0
		7	10	0	0	.21	0	2.7	0	0	0	0
			Average Snags/Acre	0	0	.21	0	2.7	0	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
		5	67							0	0	0
87	207	6	130	0	0	.26	0	4.81	0	0	0	0
		7	10							0	0	0
Alternative 1												
89	34	4	6	1.24	.01	3.88	.06	7.2	.06	0	0	2
		6	28	1.24	.01	3.31	.05	5.54	.06	0	0	1
			Average Snags/Acre	1.24	.01	3.6	0.06	6.37	.06	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												

Table 9. Current Snags/Acre, Projected Snags/Acre at 30 and 50 years Post-Treatment, Number of Partial Girdled Trees, and # Short Snags Created by Unit and Emphasis Area

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Current (2012) Snags/Acre 15-30" dbh	Current (2012) Snag/Acre >30"dbh	Projected (2042) Snags/Acre 15-30"dbh	Projected (2042) Snags/Acre >30"dbh	Projected (2062) Snags/Acre 15-30"dbh	Projected (2062) Snags/Acre >30"dbh	# of Partial Girdled Trees Created outside DCA	# of Partial Girdled Trees Created inside DCA	# of Short Snags Created
89	34	4	6	1.24	.01	9.9	.06	15.14	.10	0	0	0
		6	28							0	0	0
Alternative 1												
90	40	6	40	4.25	0	2.10	.07	4.67	.11	0	0	1
			Average Snags/Acre	4.25	0	2.10	0.07	4.67	0.11	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
90	40	6	40	4.25	0	16.31	.08	18.76	.19	0	0	0
Alternative 1 & Alternative 3												
91	9	2	9	3.68	0	13.2	.01	14.55	.02	0	0	0
			Average Snags/Acre	3.68	0	13.2	0.01	14.55	0.02	-	-	-
Alternative 2 (no action)												
91	9	2	9	3.68	0	16.32	.01	14.86	.02	0	0	0
Alternative 1 & Alternative 3												
98	63	1	43	.06	0	2.67	0	11.95	.03	0	0	0
		2	9	.06	0	2.67	0	11.95	.03	0	0	0
		5	11	.06	0	2.67	0	11.95	.03	0	0	0
			Average Snag/Acre	0.06	0	2.67	0	11.95	.03	-	-	-
Alternative 2 (no action)												
98	63	1	43	.06	0	4.59	.01	14.09	.03	0	0	0
		2	9							0	0	0
		5	11							0	0	0
Alternative 1 & Alternative 3												

Table 9. Current Snags/Acre, Projected Snags/Acre at 30 and 50 years Post-Treatment, Number of Partial Girdled Trees, and # Short Snags Created by Unit and Emphasis Area

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Current (2012) Snags/Acre 15-30" dbh	Current (2012) Snag/Acre >30"dbh	Projected (2042) Snags/Acre 15-30"dbh	Projected (2042) Snags/Acre >30"dbh	Projected (2062) Snags/Acre 15-30"dbh	Projected (2062) Snags/Acre >30"dbh	# of Partial Girdled Trees Created outside DCA	# of Partial Girdled Trees Created inside DCA	# of Short Snags Created
99	67	1	7	0	0	4.6	0	19.65	0	0	0	0
		2	4	0	0	4.6	0	19.65	0	0	0	0
		4	11	0	0	4.6	0	19.65	0	0	0	0
		5	37	0	0	4.04	0	18.11	0	0	0	0
		6	8	0	0	4.04	0	18.11	0	0	0	0
Average Snags/Acre				0	0	4.38	0	19.03	0	-	-	-
Alternative 2 (no action)												
99	67	1	7	0	0	9.78	0	19.7	0	0	0	0
		2	4							0	0	0
		4	11							0	0	0
		5	37							0	0	0
		6	8							0	0	0
Alternative 1 & Alternative 3												
100	120	1	14	1	.02	1.4	.21	2	.28	48	2	0
		2	19	1	.02	1.4	.21	2	.28	36	1	0
		4	17	1	.02	1.4	.21	2	.28	0	0	0
		5	46	1	.02	1.42	.22	1.77	.29	0	0	0
		6	24	1	.02	1.42	.22	1.77	.29	0	0	0
Average Snags/Acre				1	0.02	1.41	0.21	1.91	0.28	-	-	-
Alternative 2 (no action)												
100	120	1	14	1	.02	3.65	.26	10.73	.73	0	0	0
		2	19							0	0	0

Table 9. Current Snags/Acre, Projected Snags/Acre at 30 and 50 years Post-Treatment, Number of Partial Girdled Trees, and # Short Snags Created by Unit and Emphasis Area

Unit	Total Acres	Emphasis Area	Unit Emphasis Area Acres	Current (2012) Snags/Acre 15-30" dbh	Current (2012) Snag/Acre >30"dbh	Projected (2042) Snags/Acre 15-30"dbh	Projected (2042) Snags/Acre >30"dbh	Projected (2062) Snags/Acre 15-30"dbh	Projected (2062) Snags/Acre >30"dbh	# of Partial Girdled Trees Created outside DCA	# of Partial Girdled Trees Created inside DCA	# of Short Snags Created
		4	17							0	0	0
		5	46							0	0	0
		6	24							0	0	0
Alternative 1												
156	84	1	84	5.67	1.27	5.97	.96	10.23	.89	0	0	0
			Average Snags/Acre	5.67	1.27	5.97	0.96	10.23	0.89	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
156	84	1	84	5.67	1.27	18.49	1.03	22.97	1.03	0	0	0
Alternative 1												
163	82	1	29	2.23	0	3.45	.09	4.85	.30	0	0	8
		5	49	2.23	0	3.45	.09	4.85	.30	0	0	5
		7	4	2.23	0	3.16	.10	3.20	.24	0	0	0
			Average Snags/Acre	2.23	0	3.35	0.09	4.3	0.28	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
163	82	1	29	2.23	0	12.74	.14	17.68	.66	0	0	0
		5	49							0	0	0
		7	4							0	0	0
Alternative 1												
213	268	1	182	2.7	0	4.56	.10	11.55	.90	237	14	30
		2	11	2.7	0	3.13	.08	3.89	.35	32	1	2
		4	21	2.7	0	2.96	.08	3.49	.33	41	3	6
		5	18	2.7	0	3.13	.08	3.35	.31	32	1	2

Table 9. Current Snags/Acre, Projected Snags/Acre at 30 and 50 years Post-Treatment, Number of Partial Girdled Trees, and # Short Snags Created by Unit and Emphasis Area												
Unit	**Total Acres**	**Emphasis Area**	**Unit Emphasis Area Acres**	**Current (2012) Snags/Acre 15-30" dbh**	**Current (2012) Snag/Acre >30"dbh**	**Projected (2042) Snags/Acre 15-30"dbh**	**Projected (2042) Snags/Acre >30"dbh**	**Projected (2062) Snags/Acre 15-30"dbh**	**Projected (2062) Snags/Acre >30"dbh**	**# of Partial Girdled Trees Created outside DCA**	**# of Partial Girdled Trees Created inside DCA**	**# of Short Snags Created**
		6	25	2.7	0	2.96	.08	3.49	.33	0	0	1
		7	11	2.7	0	2.8	.08	3.23	.31	0	0	0
Average Snags/Acre				2.7	0	3.26	0.08	4.83	0.42	-	-	-
Alternative 2 (no action) & Alternative 3 (no treatment in this unit)												
213	268	1	182	2.7	0	23.7	.34	24.02	1.34	0	0	0
		2	11							0	0	0
		4	21							0	0	0
		5	18							0	0	0
		6	25							0	0	0
		7	11							0	0	0
Alternative 1 & Alternative 3												
282	108	2	46	3.49	.03	4.57	.20	6.37	.40	0	0	0
		6	62	3.49	.03	3.09	.19	2.85	.27	0	0	0
Average Snags/Acre				3.49	0.03	3.83	0.2	4.61	0.34	-	-	-
Alternative 2 (no action)												
282	108	2	46	3.49	.03	14.19	.37	14	.70	0	0	0
		6	62							0	0	0

Dense Cover Areas and Early Seral Openings

Dense cover areas (DCAs) and early seral openings (ESOs) were delineated across proposed treatment units based on topography, forest conditions, literature, professional opinion, collaboration effort and on the ground conditions. In general, the emphasis areas with a higher proportion of larger and denser trees have a higher proportion of DCAs specifically designed to meet the needs for mature and late-seral species, such as the marten, spotted owl, and goshawk. As displayed in the table below, there is a greater proportion of DCAs in emphasis areas 1, 2, 4, and 5 where greater basal area and denser forest conditions on north-facing slopes and canyon bottoms are found compared to emphasis areas 6 and 7 on southern aspects and ridgetops. For emphasis areas 1, 2, 4, and 5, DCAs range from 5% to 11% of the total emphasis area acres. In addition, the variable thinning prescription would provide additional patches of denser patches of trees that would be retained on the landscape, but these microsite conditions may be under-represented due to the course nature of the CWHR classification available to describe changes to vegetation. Post-treatment monitoring by using techniques, such as LiDAR (Garcia-Feced et al. 2011) and WorldView II imagery, would better identify the distribution of these microsite conditions of denser and larger patches across the landscape scale. Alternatively, few acres of DCAs are delineated within emphasis areas 6 and 7 where conditions are generally more open and fewer large trees are found. Similarly, a lower proportion of ESOs are proposed within emphasis areas 1, 2, 4, and 5 ranging from 0% to 3%. Whereas, ESOs proposed within emphasis areas 7 and 8 would be 4% and 7%, respectively.

Emphasis Area	% DCA of total area	% ESO of total area
1	11%	3%
2	6%	0%
4	9%	0%
5	5%	3%
6	4%	4%
7	0	7%
8	n/a	n/a

Cumulative Effects Common to All Species

In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or events contributed to those effects. Finally the Council on Environmental Quality issued an interpretive memorandum on June 34, 2005 regarding analysis of past actions, which states, "agencies can conduct an adequate aggregate effects of past actions without delving into the historical details of individual past actions." For these reasons, the analysis of past actions in this section is based on current environmental conditions. Nevertheless, in order to provide some context for past cumulative impacts, a description of recent past projects (30 years ago) is discussed.

The 29,467 acre wildlife analysis area (22,237 National Forest system lands, 7,230 Private land) is delineated to analyze cumulative effects to threatened, endangered, proposed, candidate, and Forest Service sensitive species and their habitats, including past, present, and reasonably foreseeable future actions, including the direct and indirect effects of the Sagehen Project action alternatives (e.g. disturbance related to thinning). The cumulative effects boundary extends 1.5 miles beyond the project area. This area is large enough to encompass the known home ranges of species being analyzed within the basin, yet not so large as to mask any potential effects.

Cumulative effects are defined temporally to extend approximately 30 years before and 20 years after the present; in correlation with the estimated impacts of vegetation treatments on Forest Service and private lands that are still influencing current conditions. The Donner Ridge Fire of 1960 had a profound and significant effect on vegetation conditions within the Basin, but the vegetation changes resulting from this stand replacing event have been incorporated into the existing condition. This provides a reasonable timeframe to describe changes to wildlife habitat and landscape patterns that may influence the distribution and abundance of species within the Basin and surrounding areas, including species such as the Pacific marten, Northern goshawk, and California spotted owl.

Cumulative effects from past, present, and reasonably foreseeable future projects have greatly shaped the ecosystem and wildlife habitats in the Sagehen analysis area. Although the effects of 1960 Donner Ridge Fire are reflected in the current vegetation condition, this large stand-replacing wildfire tremendously transformed the Sagehen Basin landscape in the long-term and undoubtedly had a significant impact on distributions and abundance for species such as the marten, spotted owl, and goshawk. Table 10 provides a summary of past, present, and reasonably foreseeable future actions within the spatial and temporal bounds established for the cumulative effects analysis that have affected wildlife species and their habitats.

<u>Past Projects</u>

Past timber harvest projects, particularly those from the early 1980's to the 1990's had the greatest impact on wildlife habitats within the Basin and surrounding areas. The Golden Timber Sale of 1988

harvested approximately 368 acres of forested habitat where the majority of large trees were removed resulting in the loss of old forest habitat which is still evident on the landscape today.
In addition, the Sagehen Salvage Sale of 1990 and various other sanitation and salvage projects (1988-1994) removed dead and dying trees over a broad area (>2,000 acres), affecting snag and down log associated species, including cavity-nesting birds and mammals, goshawk, marten, and spotted owl. Private land timber harvests, including 953 acres that have been subsequently acquired by the Forest Service, within the analysis area have been extensive and have included select tree harvest, clearcuts, and shelterwood cuts. Approximately 4,500 acres of timber harvests on private lands within the analysis area have removed the majority of trees above 15 inches dbh resulted in loss of old forest habitat and can be attributed to the current mid-seral forest condition that characterizes much of the existing conditions in the Basin and surrounding areas today. Recent marten research conducted within the Sagehen Experimental Forest (Moriarity et al. 2011) summarized the impacts of past timber harvest and their effects on the marten. The study suggests that the marten population within the Basin declined during this period of intensive timber harvest. Past timber harvests included in the Moriarty et al. (2011) study are also identified as past actions analyzed for cumulative effects for the Sagehen Project.

Various mastication and pre-commercial thinning projects conducted from the late 1980's to 1999 have resulted in more open and less complex understory conditions on over 1,000 acres, which has likely affected the abundance and distribution small mammals and songbird species, including prey for spotted owl, goshawk, and marten. The Sagehen and Spring Chicken fuel break projects of the late 1990's were commercial thinning treatments alongside roads to provide strategic firefighting safety zones. They removed approximately 200 trees per acre between 3 – 29.9 inches dbh, with the majority in the smaller diameter size classes (i.e. <12 inch dbh) and resulted in reduced canopy cover in both the overstory and understory vegetation. Though these types of treatments produced more open and less complex forest structure, these linear treatments were limited in their scope in terms of modifying overall forest characteristics at the stand or landscape scale. Rather they served to increase horizontal diversity and may likely have created more open situations favorable to certain prey species as well as facilitating foraging corridors for goshawk.

More recent forest management (2000-present) activities in the wildlife analysis area under the strategy of the Herger-Feinstein Quincy Library Group Forest Recovery Act Pilot Project (1999) and the Sierra Nevada Forest Plan Amendment (2004) focused on forest health and fuels reduction treatments aimed at protecting and maintaining large trees, higher canopy cover, and snags and down logs for wildlife while reducing stand-replacing catastrophic wildfires. The Scraps, Liberty, Stampede, and Zingara projects include over 500 acres of commercial thinning, group selection, and fuels treatments (mastication and underburning). Together these projects resulted in various degrees of short-term habitat change at the patch-scale, but overall project design standards were to maintain suitable habitat for the goshawk, marten, and spotted owl at the stand or landscape scale. Also, within this time period, pre-commercial thinning on over 1,000 acres removed small diameter trees, typically <10 inch dbh, aimed at reducing ladder fuels and inter-tree competition. These treatments resulted in more open and homogeneous understory conditions that likely have had localized impacts to prey species including small mammals and songbirds by reducing and eliminating cover needed for resting, foraging, and nesting. Approximately 2,000 acres of Billy Fuels Reduction Projects, including Billy Grunt and Billy Mastication, using pre-commercial thinning and mastication treatments were completed and continue to be planned within the 50-year old Donner Fire plantations. These projects, which reduced the canopy of over-dense shrubs and trees, benefitted early and mid-seral species, such as mountain quail and deer, by rejuvenating decadent, overgrown shrubs and providing travel corridors through homogeneous shrub thickets. These treatments also reduced the fire hazard risk by breaking up continuous fuel loadings.

Table 10. Effects of Past, Present, and Reasonably Foreseeable Future Projects (Analysis Area - 29,467 acres)				
Past Projects				
Year	**Project**	**Activity**	**Cumulative Effect**	**Acres**
1981-1987	Various Projects	Broadcast burning	More open understory resulting in reduced habitat quality and quantity for small mammal and bird species in the short term. No affects to overstory of CWHR.	60
1981-1987	Various Projects	Commercial Thin	Reduction in canopy cover resulting in reduced habitat quantity for late-successional wildlife species including marten, goshawk, and spotted owl	126
1981-1987	Various Projects	Overstory Removal Cut (from advanced regeneration)	Long-term removal/loss of late-successional habitat for marten, goshawk, spotted owl, increased early seral habitat for deer and mountain quail	15
1981-1987	Various Projects	Precommercial Thin	Removal of trees <6-10 inch dbh creating more open understory tree layer	205
1981-1987	Various Projects	Stand Clearcut	Long-term removal/loss of late-successional habitat for marten, goshawk, spotted owl, increased early seral habitat for deer and mountain quail	166
1981-1987	Various Projects	Tree Release and Weed	More open understory and potentially affecting small mammal and bird species in the short term. No affects to overstory of CWHR.	28
1988-1994	Sierraville RD – Various Sanitation/Salvage Projects	Sanitation/Salvage- Select tree cut that removed dead and dying trees	Removal/loss of large wood (snags and logs) resulting in long-term degradation of habitat quality and important habitat components needed for denning, resting, foraging for marten, goshawk, spotted owl	1,254
1988	Golden Timber Sale	Select Tree Cut and Seed Tree Cut that removed approximately 34 trees per acre between 12 – 35 inches dbh	Long-term removal/loss of late-successional habitat for marten, goshawk, spotted owl, increased early seral habitat for deer and mountain quail	368
1990	Sagehen Salvage Sale	Select Tree Cut that removed approximately 1-5 dead and dying trees per acre	Removal/loss of large wood (snags and logs) resulting in long-term reduction in habitat quality and important habitat components needed for denning, resting, foraging for marten, goshawk, spotted owl	800

1998-2002	Sagehen and Spring Chicken Fuel Breaks	Commercial Thin that removed approximately 200 trees per acre between 3 – 29.9 inches dbh, with the majority in the smaller diameter size classes (i.e.<12 inch dbh)	Dense canopy cover reduced to lower canopy cover, loss of understory vegetation from prescribed burning, and removal of snags/logs resulting in short-term reduction in habitat quality for marten, goshawk, spotted owl along roads. Increase in edge habitat enhanced foraging for goshawk. Limited landscape effects.	576
1981-2012	Private Land Timber Harvests	Select Tree Cut, Clearcut, Shelterwood, and thin from below that removed most trees above 15 inches dbh	Removal/loss of late-successional habitat for marten, goshawk, spotted owl, increased early seral habitat for deer and mountain quail	3,500
1994-1998	Private Land Timber Harvests that have been acquired by Forest Service	Select Tree Cut, Sanitation, Salvage, that removed most trees above 15 inches dbh	Removal/loss of late-successional habitat for marten, goshawk, spotted owl, increased early seral habitat for deer and mountain quail. Reduction in snags and logs.	953
1988-1994	Various Projects	Mastication of shrubs and sometimes small diameter trees <3 inch dbh	More open understory that reduced amount of habitat available for small mammal and bird species used for resting, foraging, and/or nesting in the short term. However, goshawk may have benefitted by enhanced travel cooridors within the tree understory. No changes to overstory of CWHR type.	53
1988-1999	Hobart YG and Other Projects	Stand Clearcut	Removal/loss of late-successional habitat for marten, goshawk, spotted owl, increased early seral habitat for deer and mountain quail	110
1988-1999	Various Projects	Pre-commercial Thin	Removal of trees <6-10 inch dbh creating more open understory tree layer that reduced habitat quality for prey species, but may have provided increased access to predators, including Northern goshawk.	1,085
1995 - 1999	Alder Prosser Compartment Plan	Commercial Thin/Mastication	Short-term reduction in canopy cover, likely resulting in more open stands and some reduction in habitat quality for late-seral species	4
2000 - 2011	Billy Fuel Reduction Project (Billy Goat)	Mastication	Removal of shrubs and sometimes small diameter trees <3 inch dbh resulting in reduction of decadent and over-dense deer brush and small trees. Benefits to early and mid-seral species by rejuvenating browse within Donner Fire Plantations	180
2000-2011	Liberty Forest Health Improvement, Stampede, and Zingara Projects	Commercial Thin/Underburn - thin from below for forest health improvement	Reduction in canopy cover that resulted in more open stands and short-term reduction in habitat quality for late-seral species	504
2000-2011	Zingara Project	Sanitation/Salvage	Removal/loss of snags and/or diseased trees resulting in long-term degradation of habitat quality and important habitat components needed for denning, resting, foraging for marten, goshawk, spotted owl	16

2010	Sagehen Test Plot	Commercial Thin/Underburn	Some short-term reduction in habitat quality for mature and late-seral species, Increase forest structure and heterogeneity, ecosystem resiliency, and fuels hazard reduction.	5
2000-2011	Liberty, Scraps, and Sagehen Test Plot	Group Select - Removal of all trees <30 in dbh between up to 1 acre	Increase in habitat for early seral species, increase in forest seral stage diversity across units, likely not to alter overall suitability of habitat for mature to late-seral forests species	43
2000-2011	Various projects including Billy Fuels Reduction, Alder Prosser Compartment Plan, Hobart YG, and Liberty Forest Health Improvement	Pre-commercial Thin	Removal of trees <10 inch dbh creating more open, homegeneous understory tree layer which reduces cover and habitat quality for wildlife, including prey species for Sensitive species	1,182
Present and Reasonably Foreseeable Future Projects				
2009-2015	Phoenix Project - Koruna and Lira Contracts	DFPZ, group selection, small group selection, variable thinning, follow up fuels treatment, underburning, hand thin and masticate.	Some short-term reduction in habitat quality for marten, goshawk, and spotted owl. Fuels hazard reduction.	562
2000 -2013	Billy Grunt	Mastication of shrubs and sometimes small diameter trees <3 inch dbh	Reduction of decadent and over-dense deer brush and small trees. Some benefits to early and mid-seral species by rejuvenating browse within Donner Fire Plantations	180
2002-2013	Billy Mass	Plantation thinning of trees <14" dbh limit with whole tree yarding and mastication with removal of trees for public fuelwood, spreading of chips and burning of slash piles	Improvement in canopy structure for early and mid-seral species with short-term impacts to prey species, such as small mammals and songbirds.	1,648
2012-2013	Outback	Aspen restoration-remove competing conifers within aspen	Increased foraging habitat quality for goshawk/marten/spotted owl, but loss of late-seral habitat.	6
2013	Sagehen Project	Variable thinning, legacy tree treatment, suppressed cut, decadent feature enhancement, dense cover areas, early seral openings, and fuels treatments including underburning, mastication, and pile burning	Short-term reduction in habitat quality in a portion of marten, goshawk, and spotted owl suitable habitat. Long-term benefits from increased forest heterogeneity, ecosystem resiliency, and fuels hazard reduction.	2,654
2013	Transition	DFPZ, group selection and variable thinning, follow up fuels treatment and underburning. Plantation treatment, masticate & grapple pile.	Short-term reduction in foraging habitat for late-seral species, such as goshawk, spotted owl, and Pacific marten. Reduced risk of stand-replacing fire event.	1,038
2012-2017	Independence Lake Forest Thinning and Fuels Reduction THP - The Nature Conservancy (Upper Sagehen Creek, Independence Lake, Lower Independence Creek)	Forest Thinning and Fuels Reduction using variable thinning, mastication, and prescribed underburning (160 acres is biomass thinning)	Short-term reduction in foraging habitat for late-seral species, such as goshawk, spotted owl, and Pacific marten, Long-term benefits from increase forest resiliency, heterogeneity, and diversity.	611
2009-2017	Independence Lake Fuel Break	1 mile length along fuelbreak	Reduction in snags and reduced canopy cover resulting in reduced habitat quality for late-seral species, such as goshawk, spotted owl, and Pacific marten	23

2014	Dry Creek	Plantation thinning, large tree treatment, dense cover areas, early seral openings, and mastication	Some short-term reduction in habitat quality for goshawk. No suitable marten or spotted owl habitat in project area.	194

Present and Reasonably Foreseeable Future Projects

The Phoenix (Koruna and Lira), Sagehen, Transition, Independence Lake, and Dry Creek Projects (4,520 acres) commercial thinning projects would all have similar short-term impacts to wildlife habitat quality by reducing overstory tree cover as well as reducing understory complexity with the overall objective of reducing fire risk hazard to forests and wildlife habitats. However, maintaining large trees, retention of moderate to high canopy cover and snags and down logs would continue to be key management objectives for long-term sustainability of mature forest species and their habitats across the landscape.

The Sagehen Project would utilize a wide variety of innovative vegetation treatments utilizing concepts presented in "An ecosystem management strategy for sierra mixed-conifer forests" aka GTR-220 (North et al. 2009) and "Managing Sierra Nevada Forests" or GTR-237 (North et al. 2012), which strive to enhance forest heterogeneity and resiliency by using topography, slope, and aspect to develop treatments that are in concert with natural fire disturbance regimes while integrating wildlife habitat objectives. The Sagehen Project would result in some short-term reduction in habitat quality for some species while enhancing forest diversity and resiliency at the stand and landscape scale. Dense cover areas, snag girdling and short snag creation would all retain and enhance vegetation conditions for species such as the marten, that have experienced population declines within the Basin and the Sierra Nevada mountains as a whole (Moriarity et al. 2011, Zielinski 2012). Compared to the no action alternative and Alternative 3, Alternative 1 best meets the intent to improve forest diversity, resiliency for wildlife in the long-term. Alternative 2 would not add to cumulative effects since habitats would be unaltered, however, actions to reduce fire risk and increased forest resiliency and heterogeneity would not be realized. Alternative 3 would result in less cumulative effects to wildlife habitats than Alternative 1, but also would not be as effective at meeting all the ecological restoration objectives, including enhancing wildlife habitats within the Basin. Alternative 1, while adding the most cumulative effects (2,750 acres) would result in short term reduction in habitat quality for old forest species, but would best meet long-term objective for providing sustainable wildlife habitats, reducing fuels risk, and achieving forest ecosystem restoration within the analysis area.

A small portion (6 acres) of the Outback Project is located within the northern part of the analysis area. This project is an aspen restoration project, with the sole purpose of restoring declining aspen forests that have been overtaken by competing conifer forests. Aspen habitats provide higher wildlife and plant species diversity compared to surrounding forested landscapes. This project benefits wildlife species diversity, including species such as mule deer, blue grouse, and numerous species of migratory songbirds. Aspen restoration also increases prey species availability for the goshawk, marten, and spotted owl. The removal of competing conifers to enhance and expand aspen would reduce existing habitat capability for some species that rely on conifer forests and would increase capability for aspen dependent species. The benefits of promoting the ecological integrity and long-term sustainability of aspen would far outweigh any short-term trade-offs of removing competing conifers due to apen's ecological importance as a rare and unique resource, and species richness and abundance.

BALD EAGLE
Status: USFS R5 Sensitive
A. Bald Eagle: Existing Environment

The bald eagle was listed as an endangered species south of latitude 40 degrees north in 1967 (the "southern" bald eagle; listed under the Endangered Species Preservation Act of 1966), was listed as endangered in most of the lower 48 states in 1978 (threatened in five States and not listed in Alaska or Hawaii), was reclassified to threatened in all lower 48 states in 1995, and was removed (delisted) from the USFWS List of Threatened and Endangered Wildlife on August 8, 2007 (USDI Fish and Wildlife Service 2007c; 72 FR 37345). Following delisting by the USFWS, the bald eagle was placed on the USFS R5 Sensitive Species List. A potential distinct population segment of the species in the Sonoran Desert of central Arizona was reinstated to threatened status by the USFWS on May 1, 2008, due to a court order (USDI Fish and Wildlife Service 2008a; 73 FR 23966), and a status review of this Sonoran Desert population is pending (USDI Fish and Wildlife Service 2009a; 74 FR 2465).

Bald eagles continue to be protected under the Migratory Bird Treaty Act of 1918 and the Bald and Golden Eagle Protection Act (BGEPA). The BGEPA prohibits "take" of bald eagles without a permit, and defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb". To help provide more clarity on the management of bald eagles following delisting, the USFWS published a regulatory definition of "disturb" (USDI Fish and Wildlife Service 2007a; 72 FR 31132). The final rule (located at 50 CFR 22.3) states: "Disturb means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior". In addition to immediate impacts, the USFWS specified that this definition also covers impacts that result from human-caused alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment (USDI Fish and Wildlife Service 2007a; 72 FR 31132).

Take of bald eagles under pre-existing Endangered Species Act (ESA) section 7 and section 10 authorizations were addressed in regulations finalized by the USFWS effective June 19, 2008 (USDI Fish and Wildlife Service 2008b; 73 FR 29075). These regulations extended BGEPA authorizations (for take) to holders of existing Endangered Species Act (ESA) section 10 permits in full compliance with the terms and conditions of the ESA permit for take, and established a new permit category to provide expedited BGEPA permits to entities authorized to take bald eagles through existing ESA section 7 incidental take statements (USDI Fish and Wildlife Service 2008b; 73 FR 29075). The USFWS finalized permit regulations under the BGEPA to authorize limited take of bald eagles, and bald eagle nests under particular limited circumstances, effective November 10, 2009 (USDI Fish and Wildlife Service 2009b; 74 FR 46836). Measures currently being taken to minimize disturbance at nesting sites should be maintained in future management for this species to ensure take does not occur, or a take permit under the BGEPA is required.

Along with the notice of delisting by the USFWS in 2007, a notice of availability was published for the draft post-delisting monitoring plan for the bald eagle (USDI Fish and Wildlife Service 2007d; 72 FR 37373). Under the draft plan, surveys will be conducted every 5 years over the next 20 years, and at the end of each 5-year monitoring event all available information would be reviewed to determine the status of the bald eagle. The draft plan involves the statistical combination of two data sets, the first of which is the continuation of nest monitoring activities conducted by each State since the mid-1980s, and the second of which are eagle habitat area plot samples across the lower 48 states. The goal of the plan is to have an 80% chance of detecting whether there has been a 25% change in the number of occupied bald eagle nests over each 5-year monitoring interval. The species' status as sensitive in Region 5 would be re-evaluated at the end of the five-year monitoring period or if there is a change in the species' status under the ESA during this period (for example, if the USFWS initiated re-listing due to information gathered from monitoring).

Critical habitat is not currently mapped or proposed for the bald eagle in the Sierra Nevada. Bald eagle habitat (nesting or winter) occurs throughout the Pacific Southwest Region, which includes both the Sierra Nevada and Klamath Provinces. The Tahoe National Forest LRMP outlines management of bald eagle nesting and wintering habitats for target populations as specified in the species recovery plan. A Tahoe National Forest Bald Eagle Management Plan (April 2, 2004) has been submitted to the USFWS. Potential and known nesting and wintering habitat has not been mapped surrounding most reservoirs and lakes on the Forest, but most potential habitat has been surveyed. The SNFPA provided no new standards and guidelines for bald eagle management. Conservation recommendations from the Biological Opinion for the SNFPA (FWS 2001) are included as management recommendations within the Tahoe National Forest Bald Eagle Management Plan. The USFWS published National Bald Eagle Management Guidelines in May 2007.

Nesting territories are normally associated with lakes, reservoirs, rivers or large streams (Lehman 1979). Bald eagle nests are usually located in uneven-aged (multi-storied) stands with old growth components (Anthony et al. 1982). Most nests in California are located in predominantly coniferous stands. Factors such as relative tree height, diameter, species, and position on the surrounding topography, distance from water, and distance from disturbance also appear to influence nest site selection (Grubb 1976, Lehman et al. 1980, Anthony and Isaacs 1981).

Trees selected for nesting are characteristically one of the largest in the stand or at least codominant with the overstory. Nest trees usually provide an unobstructed view of the associated water body and are often prominently located on the topography. Live, mature trees with deformed tops are occasionally selected for nesting. Of nest trees identified in California, about 71 percent were ponderosa pine, 16 percent were sugar pine, and 5 percent were incense cedar. The remaining 8 percent were distributed among five other coniferous species. Eagle nests may be located in snags, but most nests are probably constructed when trees were alive (Anthony and Isaacs 1989). Nest tree characteristics in California have been defined by Lehman (1980) as being 41 to 46 inches in diameter at breast height and in excess of 100 feet tall.

In California, 73 percent of the nest sites were within 0.5 mile of a body of water, and 89 percent within 1 mile. No nests were known to be over 2 miles from water. Of 21 nests in Oregon, Anthony and Isaacs (1989) found 85% were within one mile of water. Bald eagles often construct several nests within a territory and alternate between them from year to year. Up to five alternative nests may be constructed within a single territory (U. S. Fish and Wildlife Service 1986).

Snags, trees with exposed lateral limbs, or trees with dead tops are often present in nesting territories and are used for perching or as points of access to and from the nest. Such trees also provide vantage points from which territories can be guarded and defended. Andrew and Mosher (1982) found that successful nests were in denser forest stands farther from human disturbance than were unsuccessful ones. They identify the most important characteristics of bald eagle nesting habitat in the Chesapeake Bay as being close to water and having open mature vegetation structure that allows for easy flight.

Breeding is initiated as early as January 1 via courtship, pair bonding, and territory establishment, and normally ends approximately August 31, as the fledglings are no longer attached to the immediate nest site. This time frame may vary with local conditions and knowledge. Incubation may begin in late February to mid-March, with the nestling period extending to as late as the end of June. From June through August, the fledglings remain restricted to the nest until they are able to move around within their environment.

Anthony and Isaacs (1985) found negative relationships between eagle productivity and human activities, particularly logging activities. Effective breeding area management should avoid a flight response that is typically induced by disturbance at 200 to 300 m (Grubb et al. 1992). In their study of breeding bald eagle responses to human activities, Grubb et al. (1992) recommend a no activity primary zone of 500 to 600 m (1640 to 1968 feet) from nest sites, followed by a secondary zone of 1000 to 1200 m (3280 to 3936 feet).

Artificial nests are frequently proposed as mitigation where there are management conflicts. Placing artificial nests in new locations does not readily attract bald eagles, but may have application within breeding territories if they replace fallen, recently active nests (Grubb 1995a).

Wintering habitat is associated with open bodies of water, primarily in the Klamath Basin (Dietrich 1981, 1982). Smaller concentrations of wintering birds are found at most of the larger lakes, at man-made reservoirs in the mountainous interior of the north half of the state, and at scattered reservoirs in central and southwestern California. Some of the state's breeding eagles winter near their nesting territories.

The occurrence of two winter habitat features appears to play a significant role in bald eagle habitat selection during the cold months: diurnal perches and communal night roost areas. Because they are more difficult to locate and may occur some distance from the foraging source, winter roosts are at a greater risk of being removed by logging. Grubb and Kennedy (1982) state that protection of winter roosts are the most important for management considerations (Steenhof 1978 in: Grubb and Kennedy 1982) because they are continuously used and may be critical to the physical and behavioral maintenance of a population. They propose that the protection of perches is probably the least critical component of bald eagle wintering habitat, because these sites significantly vary throughout the winter and rarely limit eagle populations. However, they did find that, at reservoirs, the same perches were used more consistently than were perches along rivers.

Diurnal perches are used for foraging and are normally located in close proximity to a food source. They usually have a good view of the surrounding area and are often the highest perch sites available (Stalmaster 1976). In hardwood stands in the Chesapeake Bay, eagles preferred to use dead trees, and they used shoreline segments containing more suitable perch trees, more suitable dead trees, and a greater percent of forest cover (Chandler et al. 1995). There was a correlation with eagles using forest cover where areas were more disturbed by people. Perch trees used were large, with open, spreading form and stout, horizontal limbs. They also found that most eagles foraged within the first 50 meters (200 feet) of the water's edge; 85% used perches within 10 meters (33 feet) of the water. They recommend that management of foraging habitat: (1) create forested shorelines as close to the water as possible, (2) protect trees greater than 20 cm dbh (8 inches), and (3) leave dead trees standing.

In southwestern National Forests, Grubb and Kennedy (1982) found that although live ponderosa pine trees were the most prevalent perch trees available to eagles, they preferred to use snags instead of living trees. Use of a perch tree relates to the habitat that surrounds it. Perches were oriented to provide all of the following, but not necessarily all at the same time: (1) a good view of the adjacent water and surrounding area; (2) maximum exposure to the sun, especially during morning hours on cold days; (3) maximum benefit of topography and diurnal wind currents for flight. They found eagles selecting for perches that provide good visibility, and this is influenced by three interrelated characteristics: openness, height of the substrate, and the height of the surrounding vegetation. As foliar density of the surrounding vegetation increased, or the height of the vegetation or hill increased, so did the need for higher perches. Usually eagles chose the largest trees with suitable branches.

Habitat requirements for communal night roosting are different from those for diurnal perching. Communal roosts are invariably near a rich food resource. In forest stands that are uneven-aged, communal roosts have at least a remnant of old-growth forest components (Anthony et al. 1982). Most communal winter roosts used by bald eagles throughout the Pacific recovery areas offer considerably more protection from the weather than diurnal habitat. Of three night roosts studied in southwestern National Forests, all were in ponderosa pine stands several hundred yards to several miles from the daytime water resource (Grubb and Kennedy 1982). Most roost trees were living and well foliated, but with large "windows" in the canopy. In five communal roosts in the Klamath Basin, Keister and Anthony (1983) found that bald eagles used old-growth forest stands as far as 9.6 miles from the food source. Defoliated trees such as snags, spike-topped conifers, and large deciduous trees were especially preferred.

The most common food sources for bald eagle in the Pacific region are fish, waterfowl, jackrabbits, and various types of carrion (USDI Fish and Wildlife Service 1986). In the winter, major prey may include: waterfowl, ungulate carrion, and small mammalian prey (Grubb and Kennedy 1982, Grubb 1995b). The kinds of prey selected changes depending on its availability.

Many studies show that eagles avoid or are adversely affected by human disturbance (Stalmaster and Newman 1978, Andrew and Mosher 1982, Fraser 1985, Fraser et al. 1985, Knight and Skagen 1987, Buehler et al. 1991, Grubb and King 1991, Grubb et al. 1992, Chandler et al. 1995, Grubb et al. 1995, Mathisen et al. 1997). Disturbance is most critical during: nest building, courtship, egg laying and incubation (Dietrich 1990). Grubb et al. (1992) found that eagles are disturbed by most activities that occur within 1500 feet; and they take flight when activities occur within 600 feet. Mathisen et al. (1997) recommend that managers avoid any activities within 500 to 600 meters (1640 to 1968 feet) from a nest. They also recommend that any activities occurring within a secondary zone of 1000 to 1200 meters (3280 to 3936 feet) minimize the duration of the disturbance and avoid causing a flight response.

Eagles are disturbed differently depending on the kind of disturbance, the noise that it creates, the length of time that it lasts, and its location. Eagles are more disturbed as noise levels increase, the source of the disturbance gets closer, and by unusual disturbances not normally occurring in a particular area. Grubb and King (1991) and Grubb et al. (1992) found that pedestrian activities were the most disturbing group of human activities, followed by boats and vehicles. Among aircraft, helicopters elicited the highest disturbance response from eagles, frequently causing them to fly. They recommend permitting only short duration flights within 1100 m (3600 ft) of a nest (Grubb and King 1991), and they found that a greater frequency of disturbances appeared to have a greater effect on breeding eagles (Grubb et al. 1992). Position is also important, with activities located above an eagle being more disturbing than below.

The California Bald Eagle Habitat Management Guidelines recommends that management eliminate human disturbances at nesting areas during the breeding period, and it gives examples of closures that include signs, road closures, floating booms, and prohibition of shoreline moorage (USDA Forest Service 1977, p29). Similar closures have been implemented at locations in California that include: Shasta Lake, Little Grass Valley Reservoir, Bullards Bar Reservoir, and Stampede Reservoir.

Within Tahoe National Forest, twelve breeding territories have been identified within the forest boundary. Seven nest territories are on National Forest System land (2 at Stampede Reservoir, 1 each at Boca Reservoir, Bullards Bar Reservoir, Independence Lake, Prosser Reservoir and Deer Creek). Four nesting territories on private land occur within the forest boundary; one each at Fordyce Reservoir, Webber Lake, Spaulding Reservoir, and south of Milton Reservoir, and there is one nesting territory on State land at Donner Lake. Meadow Lake had fledglings in 2002 but no nest was located.

Tahoe National Forest lies within Zone 28 (Sierra-Nevada Mountains) of the Pacific Bald Eagle Recovery Area (USDI Fish and Wildlife Service 1986, p.138). Recovery goals identify a target of six territories on the forest, three territories at Bullards Bar Reservoir, and one territory each for Stampede, Boca, and Jackson Meadows. Considering the previously mentioned twelve territories within Tahoe National Forest (assuming the Milton Reservoir territory substitutes for Jackson because of its close proximity), recovery goals for the numbers of territories have been met.

Potential risk factors to the bald eagle from resource management activities include modification or loss of habitat or habitat components (primarily large trees) and behavioral disturbance to nesting eagles from vegetation treatment, facilities maintenance, recreation, or other associated activities within occupied habitat, which could prevent or inhibit nesting or lead to nest failure (USDA Forest Service 2001).

Conservation recommendations (USDI Fish and Wildlife Service 2001) that may be applicable to Tahoe National Forest management activities include:

1. Assist the USFWS in further implementing recovery actions identified within the Recovery Plan for the bald eagle.

2. Conduct systematic surveys across the landscape to detect additional bald eagle nests and communal night roosts.

3. Monitor bald eagle responses to human generated disturbances, including threats and changes to bald eagle habitat. If the data results indicate bald eagles are exposed and negatively impacted by disturbances, consult with the Service on ways to minimize the impacts.

4. Promote public education regarding the importance and successes of conservation and protection of the bald eagle and other listed species. This can be done using signs in occupied habitat, brochures at ranger stations, and other mediums.

5. Within two years of the signing of the Record of Decision, prepare a bald eagle management plan for every basin or site in the analysis area with occupied bald eagle territories. Each bald eagle management plan should be prepared in consultation with the Service. The objective of a bald eagle management plan should be to perpetuate existing habitat conditions in the nesting, foraging, and wintering areas to maintain nesting pairs of bald eagles and to provide for additional nesting territories,

based on the habitat suitability and carrying capacity of the area (as measured using Peterson's (1986) bald eagle habitat suitability index model). Each bald eagle management plan should address the effects of recreation, mining, timber management, residential development, hydroelectric power production, fisheries management, and other effects to bald eagles while offering measures to minimize these effects, including:

- Seasonal (January 1 to August 31 or 3 weeks after chicks have fledged) road closures within a quarter mile of bald eagle use areas should be implemented on roads, off-highway vehicle routes, or over snow vehicle routes within a quarter mile of bald eagle nesting, roosting, or wintering areas.
- Seasonal (January 1 to August 31 or 3 weeks after chicks have fledged) boating restrictions should be implemented within a quarter mile of bald eagle use areas where recreational boating and other water activities pose potential negative impacts to breeding, roosting, or wintering bald eagles.
- Seasonal (January 1 to August 31 or 3 weeks after chicks have fledged) trail restrictions should be implemented within 500 feet of a bald eagle nesting, roosting, or wintering area where hiking and bicycling trails pose potential negative impacts to the bald eagle use area.
- Non-system and other roads that lead to sensitive bald eagle habitat such as nesting, foraging, or roosting sites should be gated and bermed.
- Protection and enhancement of fish habitat in occupied bald eagle use areas through the maintenance of streambank stability by restricting activities such as, but not limited to livestock trampling, OHV use, stream crossings, and recreational use.
- Protection and enhancement of waterfowl habitat in occupied bald eagle use areas through the maintenance of riparian and lake shore vegetation (waterfowl nesting habitat) by restricting activities such as, but not limited to livestock trampling and grazing, OHV use, and recreational use.
- Seasonal restrictions on logging activities to avoid the bald eagle breeding period (January 1 to August 31 or 3 weeks after chicks have fledged) within one half mile of a nest. This should be increased to one mile for helicopter logging activities. In areas with wintering bald eagles, implement seasonal restrictions on logging activities to avoid the bald eagle wintering period (approximately November 15 to March 15) within one quarter mile of roosts, increase to one half mile for helicopter logging activities.
- Seasonal restrictions on prescribed burns. Do not implement prescribed burns within one-quarter mile of a nest during the breeding season (January 1 to August 31 or 3 weeks after chicks have fledged). If the nest is unoccupied or prescribed burns are to take place outside of the breeding season, maintain the fire at a distance of 500 feet from the nest. Fuels within a 500-foot radius of the nest should be hand thinned. In areas within 500 feet of bald eagle roosts and perches, implement seasonal restrictions on prescribed burns to avoid the bald eagle wintering period (approximately November 15 to March 15).

Project Specific Information

No bald eagle nest territories are located within the Sagehen Project area. Within the wildlife analysis area, a bald eagle nest territory is located on the western boundary of Independence Lake on the Sierraville Ranger District, over 2 ½ air miles from the nearest project unit. A wintering bald eagle roost site occurs along the Little Truckee River nearly 1 mile from project units. Incidental bald eagle sightings are known from within the analysis area during late summer, fall, and winter months.

B. Bald Eagle: Effects of the Proposed Action and Alternatives including Project Design Standards

Direct and Indirect Effects

Bald eagles that may incidentally use the Sagehen basin for foraging or movement may be directly disturbed from project activities. These activities would be short in duration, but since breeding habitat for the bald eagle does not occur within the project area, this project will not directly or indirectly affect nesting bald eagles. Therefore, project effects should not affect the distribution of breeding or winter roosting bald eagles or their habitats when they are most vulnerable to displacement or nest abandonment from ground disturbing activities.

Cumulative Effects

Within the 29,467 cumulative effects boundary, there is one known bald eagle nest territory located at the west end of Independence Lake. This territory occurs approximately 2 miles from the nearest treatment units.

Cumulative effects to bald eagles from implementing Alternatives 1 or 3 would negligible both in scope and intensity, and would only affect incidental bald eagles foraging or passing through the area. No known nesting bald eagles occur within or adjacent to project units. Therefore, the Independence Lake bald eagle territory would not be affected by project alternatives, since project units are located over 2 miles away.

C. Bald Eagle: Conclusion and Determination

It is my determination that implementation of Alternative 1 and 3 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the bald eagle within the planning area of Tahoe National Forest. In the absence of a range wide viability assessment, this viability determination is based on local knowledge of the bald eagle as discussed previously in this evaluation, and professional judgment. Incidental bald eagles that may be foraging or travelling through the Sagehen Project area may be disturbed from project activities, but nesting bald eagles will not be affected by implementing Alternatives 1 or 3 since no active bald eagle territories occur within close proximity to proposed treatment units. The Independence Lake bald eagle territory would not be affected by proposed project activities, and therefore, no cumulative effects to existing bald eagles would occur.

CALIFORNIA SPOTTED OWL

Status: USFS R5 Sensitive

A. California Spotted Owl: Existing Environment

The California spotted owl is a management indicator species on all National Forests in the Sierra Nevada Bioregion, and is listed on the USFS R5 Sensitive Species List for Tahoe National Forest. There are three subspecies of spotted owls: the California spotted owl, the northern spotted owl, and the Mexican spotted owl. Both the northern and Mexican subspecies are listed as threatened by the USFWS. The three subspecies occupy fairly geographically distinct areas, with the California spotted owl in the southern Cascades generally south of the Pit River, throughout the Sierra Nevada mountains, the mountainous regions of southern California, and the central coast ranges at least as far north as Monterey County (Gutiérrez and Barrowclough 2005). The elevation of known nest sites ranges from about 1,000 feet to 7,700 feet, with about 86 percent occurring between 3,000 and 7,000 feet. The California spotted owl has been petitioned for listing as threatened or endangered, but upon status review the USFWS has found it has not warranted listing, most recently on May 24, 2006 (USDI Fish and Wildlife Service 2003; 68 FR 7580, USDI Fish and Wildlife Service 2006; 71 FR 29886).

Risk factors for the California spotted owl include loss of habitat abundance, habitat fragmentation, reduction in habitat quality, climate change, the effects of wildfire, disturbance at breeding sites, the invasive barred owl, disease, and blood parasites (USDA Forest Service 2001a, Vol. 3, pp. 69-112, Ishak et al. 2008, USDA Forest Service 2009).

The California spotted owl has been on the USFS Region 5 Forester's Sensitive Species list since the late 1970s (Beck and Gould 1992). In 1981, Region 5 adopted a strategy for maintaining viability of the California spotted owl through a network of designated Spotted Owl Habitat Areas (SOHAs) to be managed to maintain suitable California spotted owl habitat, with 33 SOHAs in Tahoe National Forest (Beck and Gould 1992). In 1993, based on recommendations by the Technical Assessment Team to the Interagency Steering Committee for the California Spotted Owl Assessment, the "CASPO guidelines" were put in place for managing California spotted owl habitat. The CASPO guidelines were in place until January 2001 when the Record of Decision for the Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement was signed (SNFPA 2001 ROD; USDA Forest Service 2001). The SNFPA 2001 ROD outlined guidelines for management of SOHAs, Protected Activity Centers (PACs), Home Range Core Areas (HRCAs), old forest emphasis areas, and general forest that were designed to maintain important habitat elements for the California spotted owl. PACs were designated as 300 acres and HRCAs were designated as 1,000 acres (including the 300 acre PAC) of the best available habitat around spotted owl activity centers. The SNFPA 2001 ROD was replaced by the SNFPA 2004 ROD due in large part to the complexity of implementing the SNFPA 2001 ROD in meeting fuels reduction needs, and to provide more flexibility for managers to meet broader resource goals and objectives (USDA Forest Service 2004). Both SNFPA decisions (2001 and 2004) are conservation strategies for old forest and associated species designed to provide environmental conditions to maintain old forest associated species, most specifically the California spotted owl, well-distributed across Sierra Nevada national forests. The strategies seek to maintain canopy cover, big trees and stand structure known to be important to California spotted owls, while addressing the need to reduce the threat of catastrophic wildfires to owl habitat (USDA Forest Service 2004). The HFQLG pilot project is part of the SNFPA conservation strategy.

Tahoe National Forest includes one of the nine geographic areas of concern identified in the CASPO report (Beck and Gould 1992). This area of concern approximately incorporates the middle third of the forest, and was identified because the checkerboard pattern of public and private lands increases the uncertainty that owl habitat would be maintained across ownerships (Beck and Gould 1992). When combined with the natural habitat fragmentation of the higher elevations by rock outcrops and the resulting relatively low spotted owl density, landscape-scale habitat fragmentation could occur from east to west. This increases the risk to owl populations if the owl's status in the Sierra Nevada deteriorates (Beck and Gould 1992).

In February 2003, Tahoe National Forest refined existing and delineated new PACs and HRCAs according to direction in the SNFPA (USDA Forest Service 2001). This work is updated at least once a year to add new, or revise boundaries, of PACs and HRCAs. Based on GIS analysis conducted in 2009, there are approximately 150,000 acres included within approximately 181 PAC/HRCAs in Tahoe National Forest. Surveys for the California spotted owl have been conducted in Tahoe National Forest since the late 1970s. Currently, surveys conducted in Tahoe National Forest follow the Pacific Southwest Region Protocol for Surveying for Spotted Owls in Proposed Management Activity Areas and Habitat Conservation Areas (USDA Forest Service, March 12, 1991, revised February 1993). Berigan, et al. 2012 found that the USDA Forest Service management strategy relying on protecting spotted owl habitat (PACs) around owl territory centers is an integral approach in the Sierra Nevada because owls consistently use these areas over long time periods. This study found that the average size of 95% owl core use areas (334.7 acres, as defined by nest and roost locations found over long periods of time, was similar to the average PAC size (287.5 acres) for the Sierra Nevada Forests.

Spotted owl home range sizes are extremely variable across their range, and are suspected to be linked to availability of prey (Verner et al. 1992b, Zabel et al. 1992, Zabel et al. 1995, Bingham and Noon 1997). Bingham and Noon (1997) found that home range sizes of California spotted owls on Lassen National Forest (n = 4) averaged 6-8 times larger than estimates for northern spotted owls (n = 20) and noted that this is believed to reflect differences in habitat composition and prey availability rather than subspecific differences. California spotted owl home range is smallest in habitats at relatively low elevations that are dominated by hardwoods, intermediate in size in mixed-conifer forests, and largest in true fir forests (Zabel et al. 1992). At the time of the CASPO report in 1992, in the Sierran conifer forests a rough estimate of mean home range for California spotted owl pairs based on available information was 4,200 acres (Zabel et al. 1992). Call et al. (1992) found the medium summer home range in Tahoe National Forest to be 3,600 acres, though this was calculated based on data from only five owls. Bingham and Noon (1997) calculated the mean home range size for 4 individual owls on Lassen National Forest as 4,263 acres, ranging from 1,236 to 9,982 acres. In their study, core areas (polygons that included areas of the most intense use; mean 2,011 acres, range 734 to 4,161 acres) generally encompassed 20-21% of the home range and generally included 60-70% of breeding season activity (Bingham and Noon 1997). Recent research has assessed California spotted owl habitat at multiple scales. On the Lassen study area, Blakesley (2003) based her analysis on two scales, 500 acres and 2,011 acres, representing the nest area and core area. She calculated the nest area as the area encompassed by approximately ½ the minimum distance between nest sites of adjacent pairs, and based the core area on Bingham and Noon's (1997) estimated size of breeding season core areas on Lassen National Forest. On the Eldorado study area, Chatfield (2005) modeled habitat with circular plots centered on owl nest and/or roost locations of approximately 100, 300, and 1,170 acres, representing the nest stand, PAC, and territory scales, respectively. Seamans (2005), in analysis of owls on the Eldorado density study area, defined a territory as a circle with radius ½ the mean nearest neighbor distance of occupied territories, resulting in a circle encompassing 988 acres. Seamans (2005) found that this territory size (988 acres) encompassed >90% of all known roosts.

It is well-established that California spotted owls utilize various compositions of mixed conifer, ponderosa pine, red fir and montane hardwood forest types with high structural diversity, and dominated by medium (12-24") and large (>24") trees and with moderate to high levels of canopy cover (generally >40%) (Bias and Gutiérrez 1992, Call et al. 1992, Gutiérrez et al.1992, Verner et al. 1992b, Zabel et al. 1992, Moen and Gutiérrez 1997, Blakesley 2003, Blakesley et al. 2005, Chatfield 2005, Lee and Irwin 2005, Seamans 2005). Optimal habitat conditions likely involve mixtures of forest stands with differing compositions and densities (Bias and Gutiérrez 1992, LaHaye et al. 1997, Irwin et al. 2007). At the nest stand (100 acres) and PAC scale (300 acres), Chatfield (2005) found the probability of spotted owl occupancy was associated with increasing amounts of mid-seral forest having high (>70%) canopy cover and late-seral forest having at least 30% canopy cover but only to a point, beyond which the probability of occupancy approached an asymptote. Hunsaker et al. (2002) found that nesting territories (approximate 1000-acre circle around an activity center) in the southern Sierra Nevada had a *median* proportion of 60 percent of the territory with ≥50% canopy cover (i.e. one-half of the nesting territories in the study area had less than 60% of the territory with ≥50% canopy cover, and one-half of the nesting territories in the study area had more than 60% of the territory with ≥50% canopy cover). Lee and Irwin (2005) further analyzed the data presented in Hunsaker et al. (2002) and found a possible minimum threshold for nesting to occur in a territory (approximate 1000-acre circle around an activity center) to be 44% or more of the territory with ≥40% canopy cover, and that there was no significant benefit to reproduction with increasing levels of canopy cover above the threshold; "the pattern suggested a possible minimum requirement rather than a trend, with no increasing benefit to reproduction of additional amounts of intermediate [40-70%] and dense [>70%] CC [canopy cover]."

Nesting habitat has been primarily characterized by dense canopy closure (generally >70% total canopy cover above 7 feet) dominated by medium (12-24" dbh) to large (>24") trees and multi-storied structure stands (Verner et al. 1992b, Moen and Gutiérrez 1997, North et al. 2000, Blakesley 2003, Blakesley et al. 2005). Nests can be found in side cavities of live and dead firs and pines, in the top of broken-topped trees and snags, in platform nests which naturally exist in branching structures or which were built by another species, or in mistletoe brooms (Gutiérrez et al. 1992, Blakesley et al. 2005). Blakesley et al. (2005) found the mean diameter of nest trees on the Lassen study area was 46" dbh, with over 90% of nests in >30" dbh trees. Large remnant trees (>30"), even if they occur at low density (<0.5/acre), appear important to serve as nest trees (Blakesley 2003, Blakesley et al. 2005). Testing against other habitat variables, Bond et al. (2004) found the greatest association with nesting to be number of large trees (>30") and canopy cover. In the Plumas-Lassen study from 2004-2006, approximately 53% of nest sites were in CWHR 5M, 5D, and 6 tree size/canopy cover classes, 37% were in CWHR 4M and 4D, and the remaining 10% were in more open, smaller-tree size CWHR classes with nests or roosts within remnant scattered large trees (USDA Forest Service 2009). Sixty-six percent of nest and roosts that were in the CWHR 4M and 4D classes were within stands with a large tree component (>24" dbh) (USDA Forest Service 2009). Nest sites had the following mean measurements (using FIA protocol): total basal area of 260.8 ft^2/acre, 7.4 snags (>15" dbh)/acre, 10.7 large trees (>30" dbh)/acre, 64.1% canopy cover, 7.7% shrub cover, fuel loads of 0.75 tons/acre in 1-hr fuels, 4.0 tons/acre in 10-hr fuels, and 4.44 tons/acre in 100-hr fuels (USDA Forest Service 2009).

Recent telemetry studies of spotted owl foraging habitat use consistently indicate that spotted owls use a broader array of vegetation conditions for foraging than they do for nesting and roosting (Ganey et al. 2003, Glenn et al. 2007, Williams et al. 2001). Irwin et al. (2007) found optimal foraging habitat was represented by moderately-dense forest with basal area from 152 to 240 ft^2/acre in Douglas-fir, white fir, and red fir, and greater basal area of large (>8" dbh) hardwoods. Daytime roosts are typically in denser forests with greater basal area and overstory canopy cover than for nocturnal roosts (Irwin et al. 2007). Use of a broader range of vegetation conditions for foraging is likely due to the abundance and availability of important spotted owl prey species, including Northern flying squirrels, dusky-footed woodrats, deer mice, pocket gophers, birds, and other small mammals (Verner et al. 1992)

Pure eastside pine habitat is not considered to be suitable; however, eastside pine that is well stocked and has a white fir understory (e.g. portions of the transition zone on the eastside of Tahoe National Forest) may provide stand structural components that make it marginally suitable. Irwin et al. (2007) found that the probability of use as foraging habitat decreases as the basal area of ponderosa pine increases. If eastside pine habitat is considered potentially suitable, it is surveyed to protocol during project planning.

Spotted owl populations exhibit high adult survival (>80%) with little temporal variability, and highly variable reproduction and recruitment (Blakesley et al. 2001, Seamans 2005, Blakesley et al. 2006a). The spotted owl population growth rate is most dependent on adult survival (Lande 1988, Noon and Biles 1990, Blakesley et al. 2001, Seamans 2005, Blakesley et al. 2006a). The latest demographic analysis found an increase in apparent survival of adult owls over time (Blakesley et al. 2006a). While adult survival is the most important variable to the population growth rate, annual variability in the population growth rate is most influenced by reproductive output and juvenile survival (Seamans 2005). There is a high level of annual variation in the proportion of pairs that nest, and a high level of annual variation in nesting success (Noon and Biles 1990, Verner et al. 1992, North et al. 2000, Blakesley et al. 2001, USDA Forest Service 2009). Blakesley et al. (2001) found the proportion of territorial females nesting ranged from 14% in 1997 to 97% in 1992. Approximately 50% of pairs successfully reproduced in 2004 and 2007, compared to 14-18% in 2005, 2006, and 2008 on the Plumas-Lassen study (USDA Forest Service 2009). Blakesley et al. (2005) found that nest success was higher when large remnant trees (>30”) were present in the nest stand, and higher in nest stands dominated by medium sized trees (12-24”) than in stands dominated by large trees (>24”). Nesting attempts and nesting success appear to be connected to abiotic environmental factors, especially the weather (North et al. 2000, Lee and Irwin 2005, Seamans 2005, USDA Forest Service 2009). In the southern Sierra Nevada, North et al. (2000) noted that within any given year in the southern Sierra Nevada reproductive was largely synchronous among all owl pairs, negatively correlated with nesting period precipitation in oak woodlands and conifer forest, and positively correlated with April’s minimum temperature in conifer forests. Reproductive output was correlated with high levels of foliage volumes over the nest and suspected this lent protection from precipitation (North et al. 2000). Seamans (2005) modeled demographic parameters of 15 years of data on the Eldorado study area, and found that the top model suggested that reproductive output was negatively correlated with cold and wet conditions during incubation. On the Plumas-Lassen study, higher nest success was associated with relatively lower total precipitation during March and April in 2004 and 2007 compared to 2005 and 2006 (USDA Forest Service 2009). This pattern did not hold true during 2008, but the heavy snowpack that year persisting into May and June, and apparent low small mammal numbers, may have related to low nesting success (USDA Forest Service 2009). On the Lassen study area, Blakesley (2003) found that survival and reproductive output declined with increasing elevation, possibly attributable to increased snowfall and colder temperatures. LaHaye et al. (2004) found that fecundity was lower during wet spring seasons, and increased with increasing precipitation during the previous year. Prey availability, also subject to the effects of weather, can have major effects on general owl biology such as reproductive rates, timing and location of nesting, whether nesting occurs, density of nesting pairs, and dispersal or major movements of whole populations (Verner et al. 1992b).

The latest USFWS finding that the California spotted owl did not warrant listing considered the potential effects to PACs and HRCAs and the potential effects from the full implementation of the HFQLG project. The 12-month finding (USDI Fish and Wildlife Service 2006; 71 FR 29886) fully evaluated the latest meta-analysis (Blakesley et al. 2006) and found there are “… more positive indications of population trends for spotted owls of the Sierra than did the older analysis…”(page 29893), and determined that “The best-available data indicate that California spotted owl populations are stationary throughout the Sierras …In fact, there was no strong evidence for decreasing linear trends in the finite rate of population growth (lambda) on any of the four Sierra Nevada study areas …” (page 29907).

California spotted owls have strong site fidelity and establish a strong pair bond (Blakesley et al. 2006b). They do not stay together, however, during the non-nesting season (Verner et al. 1992b). They exhibit individual variation in migratory behavior; in the non-nesting season any particular owl may migrate to lower elevations, stay in the same general area used during the nesting season, or move back and forth between areas (Verner et al. 1992b). Spotted owls were found to use similar habitat conditions in the nesting and non-nesting seasons (Irwin et al. 2007). Breeding dispersal (territory or nest change between breeding attempts) of non-juvenile California spotted owls has been measured at 7% and has a higher probability of occurring in younger owls, single owls, paired owls that lost their mates, owls at lower quality sites, and owls that failed to reproduce in the prior year (Blakesley et al. 2006b).

The spotted owl is a perch and pounce opportunistic predator (Verner et al. 1992b). The northern flying squirrel (*Glaucomys sabrinus*) and dusky-footed woodrat (*Neotoma fuscipes*) comprise the two primary prey species of the California spotted owl, with the flying squirrel the predominate prey in the higher elevation conifer forest and the woodrat the predominate prey in the lower elevation forests and woodlands (Williams et al. 1992, Munton et al. 2002, USDA Forest Service 2009). Pocket gophers (*Thomomys* spp.) were the second largest component (in biomass) of owl diets on Sierra National Forest in both the higher conifer-dominated elevations and the lower woodland elevations (Munton et al. 2002). Other prey items are other small mammals (especially *Peromyscus* spp.), birds, lizards, and insects (Munton et al. 2002, USDA Forest Service 2009). California spotted owls have a remarkably low metabolic rate, and on average while feeding young would need to consume one flying squirrel or woodrat every 1.8 or 3.7 days, respectively, to meet their own energy requirements (Weathers et al. 2001). Irwin et al. (2007) found in the western Plumas National Forest area that foraging was correlated with the lower portions of slopes adjacent to small streams, and presumed this was likely due to increased prey availability in riparian areas. Small mammal populations may be subject to cyclic population fluctuations that are generally poorly understood (Oli and Dobson 2001, Coppeto et al. 2006).

Northern flying squirrels in the Sierra Nevada are arboreal mammals associated with black oak and mixed-conifer forests, and are typically found above 3,000 feet elevation (Williams et al. 1992). In the southern Sierra Nevada (Meyer et al. 2005) and in Yosemite National Park (Meyer et al. 2007a), flying squirrels have been found to use multiple nests per month; snags are preferentially selected for nesting but live trees are also used, and nest trees tend to be the largest available. Red fir is the preferred species for flying squirrel nesting; in the absence of red fir there is no tree species preference except perhaps selection against incense cedar (Meyer et al. 2005a, Meyer et al. 2007a). Canopy cover has not been found to be an important habitat variable for flying squirrels (Meyer et al. 2005a, Meyer et al. 2007a). Occupancy and nesting has been found to be correlated with proximity to perennial creeks where more xeric conditions exist in the southern Sierra Nevada (Meyer et al. 2005a), but this relationship was not found in the more mesic conditions of Yosemite National Park (Meyer et al. 2007a). Large diameter downed woody material and forest litter plays a role in production of truffles which are primary summer food sources for the northern flying squirrel and white-footed mouse, another important prey species of the spotted owl (Verner et al. 1992b). Decayed logs maintain more moisture through the dry summer months, and may influence truffle production most when the soils are the driest (Waters et al. 1997). Truffle frequency, biomass, and species richness may be greater in riparian sites than upland sites, and may be associated with the higher log density found in riparian sites (Meyer and North 2005). Truffle frequency, biomass, and species richness may be reduced in the short-term by thinning or burning (Meyer et al. 2005b). A higher amount of litter depth, and residual litter depth following prescribed burning, was important to flying squirrel presence, possibly due to a greater abundance of truffles (Meyer et al. 2007b). The winter diet of the flying squirrel is composed primarily of arboreal lichens (Verner et al. 1992b).

Dusky-footed woodrats are associated with oak woodlands, mixed-conifer, and pine-cedar forests containing a hardwood component, and occur generally below approximately 5,000 feet elevation in the Sierra Nevada (Williams et al. 1992, Coppeto et al. 2006). Their daily activities are centered around houses they construct out of vegetative material generally on the ground, but also in trees (Williams et al. 1992, Innes et al. 2008). Tree houses are generally in cavities of California black oak and snags, but are also found on limbs especially those of understory white fir (Innes et al. 2008). They eat vegetative foliage and acorns, and their diet may be locally specialized to only a few of the available plant species and can be dominated by incense cedar in mixed-conifer forest (McEachern et al. 2006). Dusky-footed woodrat abundance has been found to be positively associated with shrub density (Lee and Tietje 2005). On Plumas National Forest near Quincy, dusky-footed woodrat density was positively related to greater density of large oaks (>13” dbh), and house locations were best determined by the presence of large logs (>12” mean diameter) and large stumps (>12” diameter at root collar) and on steeper slopes, and lack of bare ground and mat-forming shrub cover. Lee and Tietje (2005) noted a steady decrease over a 4-year period in the abundance of woodrats during their study which was not explained by the variables they were studying (i.e. shrub density and burn treatment), suggesting a potential cyclic population fluctuation.

Lee and Irwin (2005) examined the potential long-term effects to California spotted owl occupancy and reproduction by landscape-level reductions in canopy cover through various combinations of mechanical forest thinning and wildland fire through six decades. They modeled various long-term scenarios of no treatment, light thinning with prescribed fire, heavy mechanical thinning, mixed-lethal fire (6 foot flame lengths), and lethal fire within spotted owl territories. The light and heavy thinning prescriptions were modeled to leave the larger trees regardless of species. Three categories of spotted owl territories were examined over a projected six decade time period, representing territories with a higher proportion of sparse canopy cover (non-reproductive territories), territories with an intermediate mix of canopy cover classes, and territories with a larger proportion of dense canopy cover. Lee and Irwin (2005) state:

> “The general trend for all scenarios except immediate lethal fire was towards higher proportions of intermediate canopy cover (40-69%) and lower proportions of sparse canopy cover (0-39%). The mechanical thinning and mechanical thinning plus DFPZ construction scenarios resulted in less of the dense canopy class (70-100%), but equal or more amounts of intermediate canopy levels than the let-grow scenario through time. Mixed-lethal fire produced a pronounced effect in the decade that the simulated fire occurred (the second decade), which was still discernible 4 decades later. None of the simulated trajectories moved beyond the range of observed variation in the original data, suggesting that expected effects on owl reproduction would be essentially immeasurable. Our simulation results lend credence to the hypothesis that modest fuels treatments are compatible with territory-level canopy cover needs for spotted owl reproduction in the Sierra Nevada.”

Lee and Irwin (2005) note that their analysis of fire effects was simplified when compared to the complex fire behavior characteristics of most landscapes, and that all potentially complex habitat elements important to spotted owls were not analyzed. They specify that the entire complex of factors affecting owls should be considered when designing and implementing thinning projects in order to minimize risk to spotted owls.

Bond et al. (2008) found that a mosaic of burn severities in a wildfire, like that which occurred in the McNally Fire on Sequoia National Forest in 2002, through previously established California spotted owl territories has been found to maintain spotted owls in the area for at least four years post-fire. The McNally Fire of 2002 burned with variable severity creating a mosaic across the landscape; of the conifer forest within the fire perimeter, 31% remained unburned, 29% burned at low severity, 27% burned at moderate severity, and 13% burned at high severity (Bond et al. 2008). In their study, low severity burned areas were preferentially selected for roost sites, and high severity burned areas were preferentially selected for foraging over unburned sites (Bond et al. 2008). Preferential use of the burned areas for foraging in this mosaic may be due to the increased shrub and forb understory, and accompanying increased prey availability as a result (Lee and Tietje 2005, Innes et al. 2007, Bond et al.

2008). In contrast, within the Moonlight and Antelope Complex Fire areas which burned primarily at high severity across approximately 88,000 acres in 2007, only 1 non-breeding pair was found within the fire area in 2008 where there had been all or parts of 23 California spotted owl PACs (USDA Forest Service 2009). Adjacent to the burned area, within the 1-mile unburned buffer surrounding the burn area perimeter, 5 confirmed pairs and 1 unconfirmed pair were found (USDA Forest Service 2009). The amount of suitable habitat (CWHR 4M, 4D, 5M, 5D) within the burned area in this case was reduced from 70.1% of the landscape to 5.8% of the landscape as a result of the fires (USDA Forest Service 2009).

Wasser et al. (1997) measured significantly higher levels of stress hormones in male northern spotted owls whose home range centers were within 0.41 km (0.25 mi.) of major logging roads or recent (10 years to present) timber activity. Forest Service recommendations for reducing direct effects to spotted owls have generally included minimizing disturbances within 0.25 miles of known roosts or nests during the breeding season (March 1 through August 31). Damiani et al. (2007, unpublished report) found that although noise from management activities conducted during the breeding season do not have immediate effects on the reproductive output of the northern spotted owl, patterns in the data suggest that in high quality habitats, disturbance (within a 0.5-mile circle centered around roosts or nests) may have cumulative negative effects on reproductive output that take at least a decade to be expressed. It was not clear whether these potential effects are caused by noise or by changes in habitat quality.

The invasive and more aggressive barred owl poses a potential threat to the California spotted owl in competition for food and nesting resources, possible displacement, hybridization with the spotted owl, and potentially increased spread of disease and blood parasites (Ishak et al. 2008, USDA Forest Service 2009). Beginning around the late 1800s, the barred owl expanded its range from the forests east of the Great Plains to forests in the western United States, arriving in northern California around the late 1970s from Oregon, and in the Sierra Nevada in the 1980s where they have continued to increase in abundance though at a slower rate than their expansion in Washington and Oregon (Livezey 2009, USDA Forest Service 2009). The barred owl is more of a habitat generalist than the spotted owl, occupying a greater variety of habitats and having a wider range of prey than the spotted owl (Livezey 2007, Livezey et al. 2008). Spotted owls have been found to have higher prevalence of blood parasite infection than barred owls in the western United States, which may translate to an additional competitive advantage for the barred owl over northern and California spotted owls (Ishak et al. 2008). There is at least one known barred owl territory in Tahoe National Forest which has existed since the early 1980s.

Project Specific Information:

Suitable spotted owl habitat (CWHR 4M, 4D, 5M, 5D, 6) within the Sagehen Basin has been surveyed to USFS Region 5 Spotted Owl protocol including historic visits since 1991. There is one California spotted owl territory (PAC NEV0059) located within the Basin. Table 11 displays a summary of spotted owl detections and reproductive status from 1991 to present. A pair of adults was initially detected in 1991 and subsequent surveys indicate the PAC continues to be occupied as evidenced by recent surveys, but reproductive status has and continues to be inconclusive. It is not known whether or not these owls have been reproductively successful within the basin. The habitat within the Sagehen Basin is generally not considered quality habitat for spotted owls compared to habitat on the westside of the Tahoe NF where the majority of spotted owls occur and where larger more contiguous tracts of higher quality suitable habitat exists. Generally, the habitat in the Basin is largely unsuitable to spotted owls, lacking in older, larger trees and dense forest conditions preferred by spotted owls as described from spotted owl studies (Blakesley 2003, Blakesley et al. 2005, USDA Forest Service 2009). In addition, eastside habitat conditions are generally, more xeric comprised largely of eastside pine, Jeffrey pine, and lodgepole pine.

Table 11. Summary of Sagehen Basin Spotted Owl PAC (NEV0059) Reproductive Status	
Year Surveyed	**Territory and Reproductive Status**
1991	Active: Pair reported
1996	Active: Agitated female response, reprod. status unknown
1997	Active: Adult response, reproductive status unknown
2003	Active: Reproductive status unknown
2004	Active: Pair detected, reproductive status unknown
2005	Active: Pair detected, reproductive status unknown
2006	Active: Female detected, reproductive status unknown
2009	Inactive
2010	Inactive
2011	Inactive
2012	Active: Adult detected, reproductive status unknown

Suitable Nesting and Foraging Habitat Description and Analysis Area

Suitable spotted owl habitat for analyzing the direct, indirect, and cumulative effects project alternatives was generated by modeling habitat using the current Tahoe NF vegetation map and Geospatial Interface tools for ArcGIS. The existing vegetation maps are classified using the CWHR classification system. CWHR habitat types used to describe suitable owl habitat are based upon the Sierra Nevada Forest Plan Amendment Record of Decision (SNFPA ROD 2001, 2004) as follows:

Table 12. California Spotted Owl High and Moderate Quality Nesting, Roosting, and Foraging Habitat			
	CWHR Type	Tree Size	Canopy Cover
High Quality Nesting/Roosting and Foraging Habitat	DFR, EPN, JPN, MHC, MHW, MRI, PPN, RFR, SMC, WFR	5, 6	M, D
High and Moderate Quality Foraging Habitat	DFR, EPN, JPN, MRI, MHC, PPN, RFR, SMC, WFR	4	M, D

Within the Sagehen Wildlife analysis area, there is a total of 29,467 acres of which 75% (22,236 ac) is on National Forest System lands (NFS) and 25% (7,230 ac) is in private ownership. Of the total NFS land in the analysis area, 2% is suitable spotted owl high quality nesting, roosting, and foraging habitat, 27% is suitable high and moderate quality foraging habitat, and 71% is not suitable based on the CWHR suitability criteria (Table 13).

Table 13. Analysis Area Acres and Percentages of Suitable Spotted Owl Habitat by Ownership						
Habitat Suitability	**Forest Service**			**Private**		
	Acres	% Habitat FS lands (22,236)	% FS Habitat in analysis area (29,467 ac)	Acres	% Habitat PVT lands (7,230 ac)	% PVT Habitat in analysis area (29,467 ac)
High Quality Nesting,	502	2	2	669	9	2

Roosting, and Foraging (1,171 ac)						
High and Moderate Quality Foraging (7,202 ac)	5871	27	20	1,331	18	5
Not Suitable (22,237 ac)	15,863	71	53	5,230	73	18
Total	**22,236**	**100**	**75**	**7,230**	**100**	**25**

Table 14 displays the acres of suitable spotted owl habitat by CWHR vegetation type, tree size class and canopy cover on Forest Service and private lands within the analysis area. The amount and type of suitable habitat in Table 13 and 14 reflects the existing current condition and for Alternative 2 No Action.

Table 14. Spotted Owl Habitat Suitability and CWHR Type, Size, and Canopy Cover by Ownership within the Analysis Area

CWHR Type	Tree Size Class	Canopy Cover Density	Forest Service Acres	Private Acres
High Quality Nesting, Roosting, and Foraging				
EPN	5	D	5.01	0
EPN	5	M	64.8	8.6
EPN	6	D	13.6	0
RFR	5	D	16.6	6.6
RFR	5	M	152.7	103.7
RFR	6	D	63.1	13.4
SMC	5	D	5.3	45.3
SMC	5	M	14.8	28.4
SMC	6	D	2.11	7.0
WFR	5	D	74.2	73.9
WFR	5	M	33.6	368.3
WFR	6	D	56.3	13.5
Total High Quality Nesting, Roosting, and Foraging			**503.2**	**668.8**
High and Moderate Quality Foraging				
EPN	4	D	826.9	9.0
EPN	4	M	888.2	71.3
RFR	4	D	536.1	79.8
RFR	4	M	565.4	292.9
SMC	4	D	1540.3	16.9
SMC	4	M	624.7	128.1
WFR	4	D	515.0	283.7
WFR	4	M	454.8	449.5
Total Foraging			**5871.0**	**1331.2**
Not Suitable				
ADS			86.0	0
BAR			250.3	204.4

BBR			637.5	28.5
EPN	1	M	6.3	0
EPN	1	S	5.4	0
EPN	1	X	96.3	0
EPN	2	D	20.2	0
EPN	2	M	22.1	0
EPN	2	P	100.3	0
EPN	2	S	242.8	4.7
EPN	3	D	309.1	0
EPN	3	M	175.1	2.7
EPN	3	P	319.7	0
EPN	3	S	232.8	0
EPN	4	P	1492.5	80.7
EPN	4	S	757.8	57.4
EPN	5	P	70.9	0.1
EPN	5	S	15.9	0
JPN	1	S	3.9	0
JPN	1	X	17.0	0
JPN	2	D	9.6	0
JPN	2	M	12.8	0
JPN	2	P	57.3	0
JPN	2	S	125.8	0
JPN	3	D	256.0	0
JPN	3	M	374.4	1.0
JPN	3	P	82.2	0
JPN	3	S	126.1	4.2
JPN	4	D	1426.5	10.0
JPN	4	M	1072.4	293.3
JPN	4	P	1184.1	156.0
JPN	4	S	403.5	75.0
JPN	5	D	0.7	34.1
JPN	5	M	72.5	39.7
JPN	5	P	39.7	18.5
JPN	5	S	12.8	
LAC			4.3	703.5
LPN	3	D	182.1	0
LPN	3	M	32.9	0
LPN	3	P	59.9	0
LPN	3	S	20.0	3.0
LPN	4	D	488.7	10.6
LPN	4	M	187.1	51.9
LPN	4	P	170.2	47.8
LPN	4	S	77.0	4.6

LPN	5	D	1.7	0
LPN	5	M	0	54.0
LPN	5	P	20.8	27.5
LPN	5	S	0	6.2
LPN	6	D	3.6	2.6
LSG	1		3.3	0
MCP			1762.2	522.5
MRI			262.5	155.7
MRI	2	M	0	87.1
MRI	3	P	0	5.2
MRI	4	D	4.7	3.2
MRI	4	M	10.3	1.2
MRI	4	P	4.5	16.5
PGS			159.8	17.3
RFR	2	M	8.6	0
RFR	2	P	9.5	2.2
RFR	2	S	0	1.8
RFR	3	D	19.2	0
RFR	3	P	21.3	142.8
RFR	3	S	26.0	8.0
RFR	4	P	384.7	440.0
RFR	4	S	214.8	155.0
RFR	5	P	37.3	97.3
RFR	5	S	0	7.3
SCN	4	M	54.8	25.3
SCN	4	P	7.3	54.3
SCN	4	S	13.7	13.1
SCN	5	M	10.3	0
SCN	5	P	16.5	8.3
SGB			74.1	5.1
SMC	1	S	0.9	29.4
SMC	3	D	14.0	0
SMC	3	M	17.4	0
SMC	3	P	29.2	0.5
SMC	3	S	62.1	16.6
SMC	4	P	373.8	40.9
SMC	4	S	88.4	9.5
SMC	5	P	125.2	107.1
SMC	5	S	24.9	61.3
URB			3.8	1.3
WFR	2	D	16.3	0
WFR	2	S	27.2	0
WFR	3	M	22.1	0

WFR	3	P	20.3	11.1
WFR	3	S	32.6	75.5
WFR	4	P	244.5	507.5
WFR	4	S	121.3	183.1
WFR	5	P	5.7	24.8
WFR	5	S	12.0	34.5
WTM			150.4	436.4
Total Not Suitable			15863.4	5230.4

Figure 2 depicts a map of suitable owl habitat within the Sagehen analysis area including proposed treatment units.

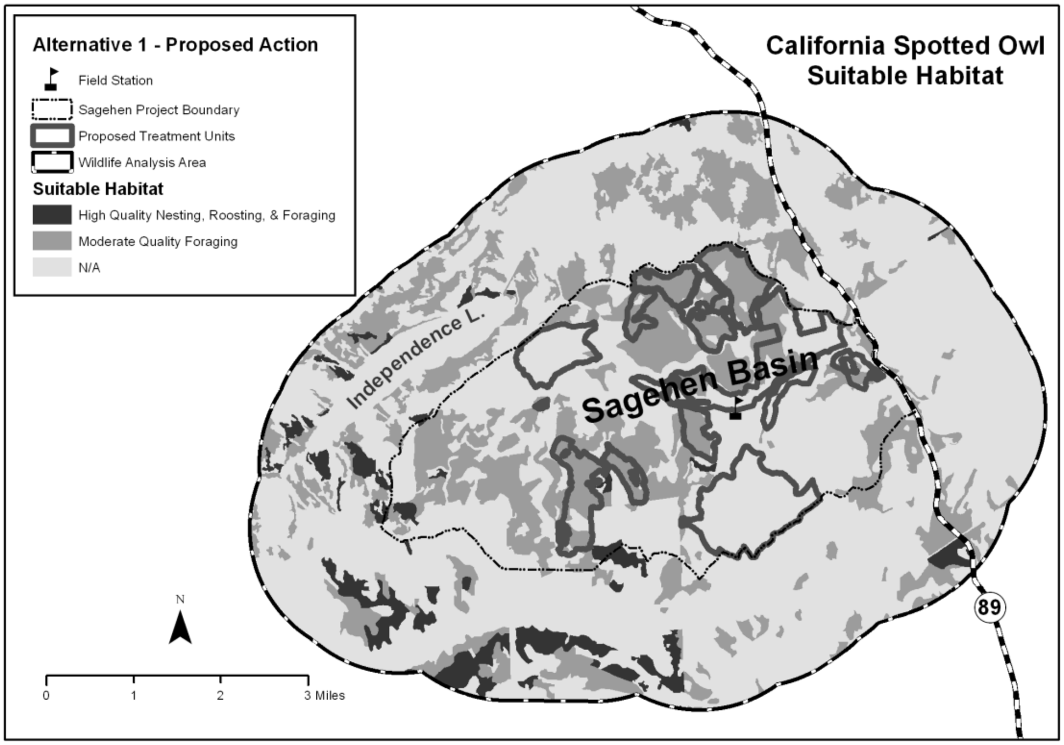

Figure 2. California Spotted Owl Suitable Habitat

B. California Spotted Owl: Effects of the Proposed Action and Alternatives including Project Design Standards

Assumptions used for the analysis:

- Adult spotted owl survivorship is positively correlated to the amount of mature forests (mid to late-successional forests)
- Spotted owl territory occupancy is positively related to the amount of mature forest within core areas and home range scales, i.e. PAC and HRCA
- High quality nesting and roosting habitat dominated by large trees, moderate to high canopy cover, abundance of snags and downed logs is related to spotted owl occupancy and reproductive success
- Spotted owl foraging habitat encompasses a broader range of vegetation conditions compared to nesting and roosting habitat, and is likely related to the availability and abundance of prey species, such as Northern flying squirrels and dusky footed woodrats, deer mice, pocket gophers, and other small mammals.
- Forest management aimed at promoting forest resiliency and patch-scale heterogeneity can meet fuels and ecological restoration objectives and provide for spotted owl habitat (North et al. 2009, North et al. 2012)

- Forest management and fuels reduction strategies using slope, topographic position and aspect that would result under a natural disturbance regime, which may result in short-term impacts of spotted owl habitat alteration, have long-term benefits on habitat for this species.

Direct Effects – Project Disturbance

A California spotted owl territory (NEV0059) located near the central portion of the Sagehen Basin has been active since 1991. Recent surveys indicate this territory remains active. Proposed treatment units in Alternatives 1 and 3 are located >1/4 mile from known nest or roost sites, and therefore would not directly affect nesting spotted owls. In the event that a new nest or roost site is identified, a Limited Operating Period would be implemented during the breeding season (March 1 to September 30) to prevent any direct disturbance from project activities.

Indirect Effects - Habitat Quantity and Quality

The indirect effects of the project alternatives to spotted owl nesting and foraging habitat will be described at two spatial scales: 1) the PAC and HRCA and 2) across the proposed treatment units. The metrics or considerations for analyzing indirect effects are as follows:

- Changes to CWHR Type, Size Class, and Canopy Cover
- Snags and Downed Log Abundance
- Habitat Fragmentation and Structural Diversity
- Forest Resiliency

<u>Protected Activity Center (PAC) and Home Range Core Area (HRCA)</u>

Within the Sagehen Basin there is one spotted owl nesting territory PAC NEV0059. No treatments are proposed within the Protected Activity Center (PAC) under Alternatives 1, 2, 3, and therefore, there would be no indirect effects of habitat alteration within the core nesting area. Findings by Berigan et al. (2012) indicate that the U.S. Forest Service management strategy which relies on protecting spotted owl habitat (PACs) around owl territory centers is integral to the conservation of spotted owls in the Sierra Nevada because owls consistently use these areas over long time periods. Therefore, it can be reasonably concluded that retaining the best available habitat within the PAC (i.e. not reducing the quantity or quality of suitable habitat) continues to be a critical strategy for conserving key habitats used by owls for nesting and roosting.

Figure 3 shows the PAC and HRCA in relation to proposed treatment units under Alternative 1 (Proposed Action).

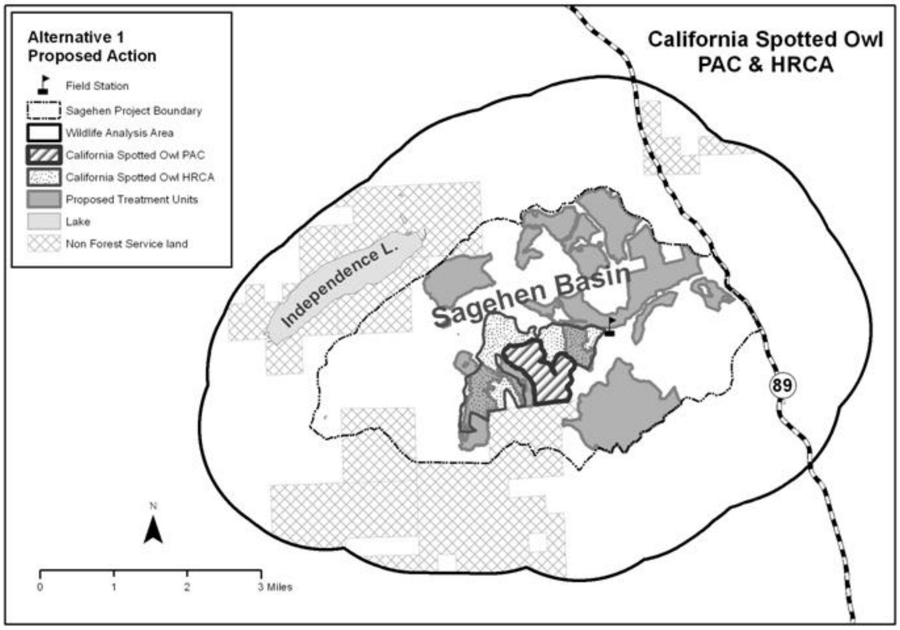

Figure 3. California Spotted Owl PAC and HRCA and Proposed Action Treatment Units

Variable Thinning, Legacy Tree Treatment, Suppressed Cut and Fuels Treatments

Table 15 provides a summary of the units, unit acres, emphasis areas, emphasis area acres, silvicultural treatment type, method, and fuels treatment with the corresponding treatment acres and changes to CWHR size and canopy cover for Alternative 1 (Proposed Action) and 3 (Non-commercial Alternative). NEV0059 HRCA falls within four treatment units (61, 156, 163, and 213). Alternative 2 is the No Action Alternative and is reflected in the current condition.

Proposed variable thinning, legacy tree treatment, and suppressed cut treatments, along with follow-up fuels treatments within the HRCA would result in residual forest conditions where existing suitable owl foraging habitat would remain suitable following treatments.

In general, hand thinning treatments (Unit 61) under Alternatives 1 and 3 would not result in any changes to CWHR types, as only small diameter trees would be removed. Fuels treatments would hand pile and burn materials removed through hand thinning. Following thinning, underburning would result in consuming some small diameter trees that are not removed by hand thinning including understory vegetation. Generally, underburning would result in approximately 30 percent of the unit affected, so not all the understory vegetation would be removed, and therefore a mosaic of habitat conditions would be present for spotted owl prey species, including small mammals, such as deer mice and flying squirrels.

Under Alternative 1, Units 156, 163, and 213 are proposed for a variety of treatments including Dense Cover Areas, Early Seral Openings, Variable Thinning, Legacy Tree Treatment, Suppressed Cut, and Decadent Feature Enhancement. Although, variable thinning, legacy tree treatments and suppressed cuts have different silvicultural objectives, changes to CWHR habitat types are not necessarily sensitive enough to detect differences from the various treatments. Therefore, variable thinning, suppressed cut, and legacy tree treatment will be considered together.

Alternative 3 proposes fuel reduction treatments using hand methods. Mechanized equipment would not be utilized under this alternative. Within the HRCA, only Unit 61 is proposed for treatment under Alternative 3. Alternative 3 proposes to hand thin 20 acres of suitable owl foraging habitat in the HRCA, compared to 234 acres of mechanical thinning treatments in Alternative 1. Alternative 3 does not change CWHR size or density classes, but would result in a 10% reduction in canopy cover. Compared to Alternative 1, Alternative 3 would have the least canopy cover reduction in spotted owl foraging habitat; however, forest resiliency and enhanced structural diversity would not be achieved on 234 acres within the HRCA, where stand replacing fires would remain a higher risk compared to Alternative 1.

Table 15. Changes to CWHR Types within Spotted Owl HRCA (NEV0059) By Unit, Treatment Type, Method, and Fuels Treatment									
Alternative 1									
Unit	Unit Acres	Emphasis Area	Emphasis Area Acres	Treatment Type	Method	Fuels Treatment	Treatment Acres	Current CWHR	Post-treatment CWHR
61	20	1	15	Variable Thin; Suppressed Cut	Hand	Hand Pile; Pile Burn; Underburn	15	4D	4D
				Dense Cover Area	No harvest	None	2	4D	4D
		2	5	Variable Thin; Suppressed Cut	Hand	Hand Pile; Pile Burn; Underburn	5	4D	4D
				Dense Cover Area	No harvest	None	0.5	4D	4D
156	84	1	84	Dense Cover Area	No harvest	Underburn	1.7	4D	4D
				Early Seral Opening	Mechanical	Grapple Pile; Pile Burn	0.8	4D	Early Seral Opening
				Variable Thin; Legacy Tree Treatment; Suppressed Cut	Mechanical	Grapple Pile; Pile Burn	22.9	4D	4M
							3.6	4M	4M
163	82	1	29	Dense Cover Area	No harvest	Underburn	4.2	4D	4D
				Early Seral Opening	Mechanical	Grapple Pile; Pile Burn; Underburn	1.6	4D	Early Seral Opening
				Variable Thin; Legacy Tree Treatment; Suppressed Cut; Decadent Feature Enhancement	Mechanical	Grapple Pile; Pile Burn; Underburn	20.8	4D	4M
							0.3	4M	4M
		5	49	Dense Cover Area	No harvest	Underburn	2.7	4D/P	4D/P
				Early Seral Opening	Mechanical	Grapple Pile; Pile Burn; Underburn	2.1	4D/M	Early Seral Opening

				Variable Thin; Legacy Tree Treatment; Suppressed Cut; Decadent Feature Enhancement	Mechanical	Grapple Pile; Pile Burn; Underburn	27.4	4D	4M
							10.3	4M	4M
		7	4	Early Seral Opening	Mechanical	Grapple Pile; Pile Burn; Underburn	0.8	4M	Early Seral Opening
				Variable Thin; Legacy Tree Treatment; Suppressed Cut; Decadent Feature Enhancement	Mechanical	Grapple Pile; Pile Burn; Underburn	2.8	4M	4M
213	268	1	182	Dense Cover Area	No harvest	N/A	8.6	4D	4D
				Early Seral Opening	Mechanical	Grapple Pile; Pile Burn	3.6	4D	Early Seral Opening
				Variable Thin; Legacy Tree Treatment; Suppressed Cut; Decadent Feature Enhancement	Mechanical	Grapple Pile; Pile Burn	0.05	5D	5M
							97.9	4D	4M
							0.24	4M	4M
							1.9	4P	4P
							1.1	4S	4S
		2	11	Dense Cover Area	No harvest	N/A	1	4D	4D
				Variable Thin; Legacy Tree Treatment; Suppressed Cut; Decadent Feature Enhancement	Mechanical	Grapple Pile; Pile Burn	1.4	5D	5M
							8.1	4D	4M
							0.2	4S	4S
		4	21	Dense Cover Area	No harvest	N/A	1.9	4D	4D
				Variable Thin; Legacy Tree Treatment; Suppressed Cut; Decadent Feature Enhancement	Mechanical	Grapple Pile; Pile Burn	7.4	4D	4M
							0.3	4P	4P
		5	18	Dense Cover Area	No harvest	N/A	0.9	4D	4D
				Early Seral Opening	Mechanical	Grapple Pile; Pile Burn	0.4	4D	Early Seral Opening

				Variable Thin; Legacy Tree Treatment; Suppressed Cut; Decadent Feature Enhancement	Mechanical	Grapple Pile; Pile Burn	5.9	4D	4M
		6	25	Variable Thin; Legacy Tree Treatment; Suppressed Cut; Decadent Feature Enhancement	Mechanical	Grapple Pile; Pile Burn	6.4	4D	4M
	454		443				238.2		
Alternative3									
Unit	Unit Acres	Emphasis Area	Emphasis Area Acres	Treatment Type	Method	Fuels Treatment	Treatment Acres	Current CWHR	Post-treatment CWHR
61	20	1	15	Variable Thin; Suppressed Cut	Hand	Hand Pile; Pile Burn; Underburn	15	4D	4D
				Dense Cover Area	No harvest	None	2	4D	4D
		2	5	Variable Thin; Suppressed Cut	Hand	Hand Pile; Pile Burn; Underburn	5	4D	4D
				Dense Cover Area	No harvest	None	0.5	4D	4D

Table 16. Acres of Changes to CWHR by Spotted Owl Nesting and Foraging Habitat within HRCA (NEV0059) from Variable Thinning, Legacy Tree Treatment, and/or Suppressed Cut

Alternative 1

Unit	Unit Acres	Emphasis Area	Emphasis Area Acres	Variable Thinning, Legacy Tree Treatment and/or Suppressed Cut	Nesting Habitat (CWHR 5M, 5D, 6)	Foraging Habitat (CWHR 4M, 4D)				Unit Average Canopy Cover	
					Nesting Habitat Acres	Foraging Habitat Acres	Current Tree Size and Canopy Cover	Post-Treatment Tree Size and Canopy Cover	Acres Change in Tree Size and Canopy Cover Class	Current	Post-Treatment
61	20	1	15	14.5	0	14.5	4D	4D	0	74	64
		2	5	5.3		5.3	4D	4D	0		
156	84	1	84	25.9	0	22.3	4D	4M	22.3	75	54
						3.6	4M	4M	0		
163	82	1	29	21.1	0	20.8	4D	4M	20.8	66	50
						0.3	4M	4M	0		
		5	49	37.6	0	27.4	4D	4M	27.4		
						10.2	4M	4M	0		
		7	4	2.8	0	2.8	4M	4M	0		
213	268	1	182	97.8	0	97.6	4D	4M	97.6	68	55
						0.2	4M	4M	0		
		2	11	9.5	0	1.4	5D	5M	1.4		
						8.1	4D	4M	8.1		
		4	21	7.4	0	7.4	4D	4M	7.4		
		5	18	5.9	0	5.9	4D	4M	5.9		
		6	25	6.4	0	6.4	4D	4M	6.4		
Totals	**454**		443	**234.4**	0	**234.4**			**197.3**		

Alternative 3

Unit	Unit Acres	Emphasis Area	Emphasis Area Acres	Variable Thinning, Legacy Tree Treatment and/or Suppressed Cut	Nesting Habitat (CWHR 5M, 5D, 6)	Foraging Habitat (CWHR 4M, 4D)				Unit Average Canopy Cover	
					Nesting Habitat Acres	Foraging Habitat Acres	Current Tree Size and Canopy Cover	Post-Treatment Tree Size and Canopy Cover	Acres Change in Tree Size and Canopy Cover Class	Current	Post-Treatment
61	20	1	15	14.5	0	14.5	4D	4D	0	74	64
		2	5	5.3		5.3	4D	4D	0		
Total	**20**			**19.8**	**0**	**19.8**					

Table 16 displays the changes to spotted owl nesting and foraging habitat by CWHR size and canopy cover within the HRCA NEV0059. No suitable high and moderate quality nesting habitat (5M, 5D, 6) would be affected by proposed variable thinning, legacy tree treatment or suppressed cutting (Table 10). There are approximately 234acres (33%) out the 714-acre HRCA (not including the 296-acre PAC) that are proposed for thinning treatments under Alternative 1 and would remain suitable for foraging post-treatment, but would be reduced in quality. However, 197 out of 234 acres would change from a CWHR 4D (60-100%) to 4M (40-59%) type; and 37 acres currently typed as CWHR 4M would remain as CWHR 4M post-treatment. A unit by unit summary of changes to suitable spotted owl foraging habitat from proposed treatments are described below. Suitable nesting habitat (CWHR 5M, 5D, 6) does not occur in any of the proposed treatments, and therefore would not be affected.

Unit 61 (Emphasis Areas 1, 2)

Twenty acres of suitable spotted owl foraging habitat in the HRCA proposed for variable thin and suppressed cut would remain CWHR 4D post-treatment under Alternatives 1 and 3. The average unit canopy cover would be reduced from 74% to 64%, where habitat suitability would remain unchanged. Habitat quality would be slightly reduced, but would not likely significantly affect spotted owl habitat suitability for foraging owls.

Unit 156 (Emphasis 1)

Within the HRCA, approximately 26 acres of suitable foraging habitat proposed for variable thin, legacy tree treatment, and suppressed cut. Twenty-two acres would change from CWHR 4D to 4M, where habitat quality would be reduced. However, habitat suitability would be unchanged following treatments. An additional 2 acres would remain CWHR 4M after treatment. The unit average canopy cover would change from 75% to 54% following treatments.

Unit 163 (Emphasis Areas 1, 5, 7)

In Unit 163, within the three emphasis areas, a total of 48 out 61 acres foraging habitat in the HRCA would change from a CWHR 4D to 4M following proposed treatments, resulting in reduced habitat quality. The remaining 13 acres of foraging habitat classified as CWHR 4M would remain 4M. The unit average canopy cover would change from 66% to 50% as a result of treatments.

Unit 213 (Emphasis Areas 1, 2, 4, 5, 6)

The majority of this large 268-acre unit falls within Emphasis Area 1 which is predominantly located on north facing slopes, but does include some ridges, and some higher elevation south facing slopes (above 6,725 feet). In the HRCA, 121 acres of suitable foraging habitat are proposed for variable thinning, legacy tree treatment or suppressed cutting treatments, with 98 acres in Emphasis Area 1 and the remaining spread across the other emphasis areas ranging from 1 to 8 acres. All 121 acres of suitable habitat would change from CWHR 4D to 4M. The unit average canopy cover would change from 68% to 55%, where foraging habitat quality within the HRCA would be reduced in the short-term. However, the existing foraging habitat within the HRCA would remain suitable for foraging following the treatments.

Dense Cover Areas (DCAs) and Early Seral Openings (ESOs) in Spotted Owl HRCA (NEV0059)

Units: 61, 156, 163, 213,
(all emphasis areas),

As described in the proposed action, dense cover areas (DCAs) are small areas distributed within treatment units that provide continuous vertical and horizontal cover with a mixture of shrubs and trees along with large and small down wood, snags, and high stumps. DCAs would typically contain clumps of trees of various size classes as well as a variety of snag and down wood sizes. These DCAs, ranging in size from 0.25-1 acre, would contribute to/enhance within-stand horizontal and vertical structural diversity and provide important old forest and/or mid seral habitat elements within the HRCA.

ESOs would be comprised of dense young regenerating trees and/or shrubs to provide early successional habitat within larger stands managed for late successional or old forest habitat. ESOs, from 0.25-0.50 acre, would enhance within-stand age and species diversity. ESOs would be created by taking advantage of existing conditions, such as areas of sparse tree cover, thinner soils, or pockets of extensive tree mortality. Openings would be created by removing most or all of the existing trees and either planting or allowing natural shrub and/or tree regeneration to create an ESO of early successional habitat. Within ESOs (regeneration areas), prescribed fire would be applied to regenerate shrubs and create suitable areas for shade-intolerant tree species to regenerate.

For DCAs comprised of multiple sizes of trees, snags, and down wood, prescribed fire would be carefully applied to maintain key habitat elements, particularly snags and down wood. Underburning in DCAs comprised of multiple sizes of trees, snags, and down wood would likely result in some mortality of suppressed and subdominant trees. Burning prescriptions would be designed to ensure the overall structure of the DCA would remain intact.

Table 17 displays the distribution and acres of DCAs and ESO's within proposed treatment units located within NEV0059 HRCA and shows the changes to CWHR type for Alternatives 1 and 3. Under Alternative 1, approximately 24 acres of DCAs within the HRCA would be designated for retention and would continue to provide areas of higher canopy, vertical and horizontal structure, down wood, snags, and high stumps in their existing condition. The 9 acres of ESOs scattered across 3 units (156, 163, 213) in the HRCA would result in removal of all existing trees and would eventually be planted or naturally regenerate over time. The CWHR vegetation class in ESOs would likely remain the same as the current existing vegetation following treatment because it is expected that they would eventually become naturally regenerated with existing surrounding tree species. However, the CWHR tree size and canopy classes would be changed to early seral openings following treatments, as all trees would be removed. It is expected that the ESOs would eventually become forested and not result in long-term type conversion. Additionally, the ESOs would not alter or change the habitat suitability for spotted owls across the units or would not result in habitat fragmentation at the landscape level. These DCAs and ESOs combined with variable thinning, legacy tree treatments, suppressed thinning, and associated fuels treatments would result in a more diverse and resilient landscape within and surrounding the 1,010-acre HRCA (296-ac PAC plus surrounding 714-ac HRCA), although localized effects from the treatments would vary depending upon the size of the openings and site-specific conditions. Generally, the creation of early seral openings would be expected to result in increased shrubs, which would benefit prey species diversity. The overall effects to the HRCA would be minimal, since the openings are small and scattered.

Alternative 1 would provide more structural diversity within the HRCA from DCAs and ESOs scattered throughout across 486 acres within Units 61, 156, 163, and 213 compared to both Alternatives 2 and 3. Under Alternative 3, the non-commercial funding alternative, only Unit 61 is proposed for treatment (Table 16), where a total of 2.5 acres of DCAs are proposed within the 20-acre unit. There would be no ESA treatments within the HRCA for Alternative 3. For Alternative 2 there would be no implementation of DCAs or ESOs: the HRCA would remain in the existing condition and would not provide for increased vegetation structural and age class diversity across the 486 acres.

Table 17. Acres of Dense Cover Areas and Early Seral Openings and Changes to CWHR Types within Spotted Owl HRCA (NEV0059)											
Alternative 1											
Unit	**Unit Acres**	**Emphasis Area**	**Emphasis Area Acres**	**Treatment Type**	**Method**	**Fuels Treatment**	**Total DCA/ESO Acres**	**Current CWHR**	**Currently Suitable (Y/N)**	**Post-treatment CWHR**	**Suitable Post-treatment (Y/N)**
61	20	1	15	Dense Cover Area	No Harvest Area	None	2	LPN/WFR4D	y	LPN/WFR4D	Y
		2	5				0.5	LPN/WFR4	y	LPN/WFR4D	Y
156	84	1	84	Dense Cover Area	No Harvest Area	None	1.7	LPN4D	Y	LPN4D	Y
								SMC4D	Y	SMC4D	Y
								WFR4D	Y	WFR4D	Y
								WFR4M	Y	WFR4M	Y
				Early Seral Opening	Mechanical	Grapple Pile; Pile Burn	0.8	SMC4D	Y	SMC - Early Seral Opening	N
								WFR4D	Y	WFR - Early Seral Opening	N
								WFR4M	Y	WFR - Early Seral Opening	N
163	82	1	29	Dense Cover Area	No Harvest Area	Underburn	4.2	SMC4M	Y	SMC4M	Y
								WFR4D	Y	WFR4D	Y
				Early Seral Opening	Mechanical	Grapple Pile; Pile Burn; Underburn	1.9	LPN4D	Y	LPN - Early Seral Opening	N
								WFR4D	Y	WFR - Early Seral Opening	N
		5	49	Dense Cover Area	No Harvest Area	Underburn	2.7	LPN4P	N	LPN4P	N
								SMC4D	Y	SMC4D	Y
				Early Seral Opening	Mechanical	Grapple Pile; Pile Burn; Underburn	2.1	SMC4D	Y	SMC - Early Seral Opening	N
								SMC4M	Y	SMC - Early Seral Opening	N
		7	4	Early Seral	Mechanical		0.8	SMC4D	Y	SMC - Early Seral	N

				Opening						Opening	
213	268	1	182	Dense Cover Area	No Harvest Area	None	8.6	SMC4D	Y	SMC4D	Y
								SMC4S	N	SMC4S	N
								WFR4D	Y	WFR4D	Y
				Early Seral Opening	Mechanical	Grapple Pile; Pile Burn	3.6	RFR4D	Y	RFR - Early Seral Opening	N
								WFR4D	Y	WFR - Early Seral Opening	N
		2	11	Dense Cover Area	No Harvest Area	None	1	RFR4D	Y	RFR4D	Y
								RFR4D	Y	RFR4D	Y
		4	21	Dense Cover Area			1.9	ADS	N	ADS	N
								SMC4D	Y	SMC4D	Y
		5	18	Dense Cover Area			0.9	SMC4D	Y	SMD4D	Y
		6	25	Dense Cover Area			0.9	SMC4D	Y	SMC4D	Y

Alternative 3

Unit	Unit Acres	Emphasis Area	Emphasis Area Acres	Treatment Type	Method	Fuels Treatment	Total DCA/ESO Acres	Current CWHR	Currently Suitable (Y/N)	Post-treatment CWHR	Suitable Post-treatment (Y/N)
61	20	1	15	Dense Cover Area	No Harvest Area	None	2	LPN/WFR4D	y	LPN/WFR4D	Y
		2	5				0.5	LPN/WFR4	y	LPN/WFR4D	Y

Indirect Effects to Suitable Spotted Owl Habitat

Suitable spotted owl foraging and nesting habitat was assessed for their potential effects from proposed activities for each of the action alternatives (Table 18). No suitable nesting habitat (CWHR 5M, 5D, 6) occurs within proposed treatment units for Alternatives 1 and 3, and therefore would not be affected by thinning or fuels treatments. Under Alternative 1, 1,280 suitable spotted owl foraging habitat is proposed for thinning out of the total 2,485 acres that would be treated. Thinning and fuels treatments, including variable thinning, legacy tree treatments, and suppressed cutting would result in 798 acres that would be reduced in habitat quality where CWHR 4D types would change to CWHR 4M types. On all 1,280 of suitable foraging habitat, canopy cover would be reduced, but foraging habitat would remain suitable following treatments. Current unit average canopy cover ranges from 51% to 80% and post-treatment average canopy cover would range from 41% to 71%.

Under Alternative 3, 112 acres of suitable foraging habitat proposed for treatments would result in lowered canopy cover in the short term, where 19 acres would change in CWHR type 4D to 4M. However, under Alternative 3, the opportunity to increase and enhance forest resiliency and structure diversity would not be achieved on 1,168 acres that are proposed for treatments under Alternative 1. Similar to Alternative 1, nesting habitat would not be affected by Alternative 3 activities. The average unit canopy cover for units proposed for treatment under Alternative 3 currently ranges from 51% to 76%. Average canopy cover for the units following treatments would range from 41% to 64%.

Under Alternative 2, no action, 1,280 acres suitable foraging habitat would not be treated and therefore, canopy cover would not change or be reduced in quality. However, forest resiliency, forest structural diversity, and reduced fuels hazard would not be realized under the no action alternative. In the long-term, spotted owl foraging habitat, including those within and surrounding the PAC, would remain at a higher risk of potentially severe wildfire effects under the no action alternative.

Table 18. Acres of Current and Post-Treatment CWHR Size and Canopy Cover within Spotted Owl Nesting and Foraging Habitat									
Alternative 1									
Unit	Unit Acres	Treatment Acres	Nesting Habitat	Foraging Habitat				Unit Average Canopy Cover	
			Nesting Habitat Acres (5M, 5D, 6)	High and Moderate Foraging Habitat Acres (4M, 4D)	Current Tree Size and Canopy Cover	Post-Treatment Tree Size and Canopy Cover	Acres Change in Tree Size and Density Class	Current	Post-Treatment
33	118	104	0	40	4D	4M	40	71%	44%
				16	4D	4P	16		
				8	4M	4M	0		
				32	4M	4P	32		
34	68	62	0	55	4D	4M	55	70%	53%
				1	4M	4M	0		
35	64	57	0	17	4D	4M	17	68%	47%
				11	4M	4M	0		
36	101	92	0	36	4D	4M	36	75%	50%
				44	4M	4M	0		
38	210	177	0	107	4D	4M	107	73%	49%
				52	4M	4M	0		
39	32	32	0	21	4D	4D	0	72%	71%
				8	4M	4M	0		
46	621	621	0	170	4M	4M	0	51%	41%
47	33	33	0	0	None	None	0	51%	46%

61	20	20	0	12	4D	4D	0	74%	64%
73	144	131	0	66	4D	4M	66	72%	51%
				20	4M	4M	0		
76	91	91	0	2	4D	4M	2	56%	43%
80	5	5	0	5	SMC4D	ASP4M	5	>60%	<60%
85	64	57	0	5	4D	4M	5	62%	54%
87	207	207	0	0.1	4D	4M	0.1	60%	46%
89	34	30	0	2	4D	4M	2	80%	56%
90	40	37	0	31	4D	4M	31	78%	51%
				4	4M	4M	0		
91	9	9	0	1	4D	4M	1	62%	58%
98	63	63	0	0	None	None	0	59%	40%
99	67	44	0	30	4D	4D	30	59%	63%
100	120	120	0	12	4D	4D	0	64%	60%
				63	4D	4M	63		
				10	4M	4M	0		
156	84	76		45	4D	4M	45	75%	54%
			0	21	4M	4M	0		
163	82	70	0	51	4D	4M	51	66%	50%
				13	4M	4M	0		
213	268	239	0	1	5D	5D	0	68%	55%
				178	4D	4M	178		
				21	4M	4M	0		
282	108	108	0	16	4D	4M	16	76%	59%
Totals	**2653**	**2485**		**1,280**			**798.1**		

Alternative 3

Unit	Unit Acres	Treatment Acres	Nesting Habitat Acres (5M, 5D, 6)	Foraging Habitat Habitat Acres (4M, 4D)	Current CWHR Tree Size and Canopy Cover	Post-Treatment CWHR Tree Size and Cover	Acres Change in CWHR Tree Size and Canopy Cover	Current Unit Average Canopy Cover	Post-Treatment Unit Average Canopy Cover

46	621	621	0	0.3	4M	4M	0	51%	41%
47	33	33	0	0	NA	NA	0	51%	46%
61	20	20	0	12	4D	4D	0	74%	64%
76	91	91	0	2	4D	4M	2	56%	43%
91	9	9	0	1	4D	4M	1	62%	58%
98	63	63	0	0	NA	NA	0	59%	40%
99	67	67	0	30	4D	4D	0	59%	63%
100	120	120	0	41	4D	4D	0	64%	60%
			0	10	4M	4M	0		
282	108	108	0	16	4D	4M	16	76%	59%
Totals	**1132**	**1132**	**0**	**112.3**			**19**		

Table 19 displays a summary of changes to CWHR types for 1,280 acres of suitable foraging habitat by treatment units. All 1,280 would have reduced foraging habitat quality, as stated above. For Alternative 1, 76 acres would remain unchanged in the CWHR 5D/4D type, 40 acres would change from CWHR 4D to 4M, 16 acres would change from 4D to 4P, 383 acres of CWHR 4M types would remain unchanged, and 32 acres would change from CWHR 4M to 4P types. Although Emphasis Area 6 within Unit 33 would reduce canopy cover to 38% post-treatment, the average canopy across the unit would result in a post-treatment canopy cover of 44%, and would therefore meet Forest Plan standards and guidelines for mechanical thinning. Treatments would result in increased structural diversity and forest resiliency through reduced hazard fuels while maintaining large trees and moderate canopy cover required for nesting.

For Alternative 3, 112 acres of suitable foraging habitat proposed for treatments would result in 83 acres that would remain as CWHR 4D, 10 acres would stay as CWHR 4M, and 19 acres would change from CWHR 4D to 4M following treatments, where habitat quality would be reduced. The quantity of suitability foraging habitat would be unchanged post-treatment.

Table 19. Acre Summary of Changes to CWHR types within Suitable Foraging Habitat

Alternative 1						
Unit	Unit Acres	Post-treatment Acres of CWHR Class Unchanged (4D remaining 4D)	Post-treatment Acres of Changes in CWHR Class (4D to 4M)	Post-treatment Acres of Changes in CWHR Class (4D to 4P)*	Post-treatment Acres of CWHR Class Unchanged (4M remaining 4M)	Post-treatment Acres of Changes in CWHR Class (4M to 4P)
33	118	0	40	16	8	32
34	68	0	55	0	1	0
35	64	0	17	0	11	0
36	101	0	36	0	44	0
38	210	0	107	0	52	0
39	32	21	0	0	8	0
46	621	0	0	0	170	0
47	33	0	0	0	0	0
61	20	12	0	0	0	0
73	144	0	66	0	20	0
76	91	0	2	0	0	0
80*	5	0	5	0	0	0
85	64	0	5	0	0	0
87	207	0	0.1	0	0	0
89	34	0	2	0	0	0
90	40	0	31	0	4	0
91	9	0	1	0	0	0
98	63	0	0	0	0	0
99	67	30	0	0	0	0

100	120	12	63	0	10	0
156	84	0	45	0	21	0
163	82	0	51	0	13	0
213	268	1	178	0	21	0
282	108	0	16	0	0	0
Totals	**2,653**	**76**	**720.1**	**16**	**383**	**32**

Alternative 3				
Unit	Unit Acres	Post-treatment Acres of CWHR Class Unchanged (4D remaining 4D)	Post-treatment Acres of Changes in CWHR Class (4D to 4M)	Post-treatment Acres of CWHR Class Unchanged (4M remaining 4M)
46	621	0	0	0.3
47	33	0	0	0
61	20	12	0	0
76	91	0	2	0
91	9	0	1	0
98	63	0	0	0
99	67	30	0	0
100	120	41	0	10
282	108	0	16	0
Totals	**1,132**	**83**	**19**	**10.3**

*Post-treatment canopy cover for Unit 33 would meet Forest Plan standards and guidelines for mechanical fuels treatments.

Dense Cover Areas (DCAs) and Early Seral Openings (ESOs) in Suitable Spotted Owl Habitat

Tables 20 and 21 display acres of Dense Cover Areas (DCA's) and Early Seral Openings (ESOs) within Treatment Units by CWHR types and spotted owl habitat suitability for Alternative 1. DCA's are areas that are delineated within treatment areas that will remain intact and provide high to moderate quality spotted owl foraging habitat which typically provide areas of higher canopy cover and larger trees compared to the surrounding areas. Alternative 1 proposes to delineate a total of 81 acres of DCAs, of which 12 acres are not suitable and 69 acres are suitable for foraging. Suitable nesting habitat is very limited within the Sagehen Basin and additionally, negligible suitable nesting habitat lies within proposed treatment units. Suitable nesting habitat is not affected by any ESO treatments.

Alternative 1 proposes to create a total of 54 acres of ESOs, of which 8 acres are not suitable and 46 acres are suitable spotted owl foraging habitat.

Under Alternative 3 DCAs would only be designated and created within the 1,132 acres fuels treatment units (46, 47, 61, 76, 91, 98, 99, 100, and 282) of which only 112 acres (10%) are suitable foraging habitat for spotted owls. The DCAs would retain patches of the large trees available through the hand thinning units under Alternative 3, and would contribute to increased structural diversity across 1,132 acres compared to the 2,653 acres in Alternative 1 where both DCAs and ESOs would be implemented. Alternative 2 would have the least impacts to spotted owl habitat since ESOs would not be created where all the trees would be harvested. However, Alternative 2 would provide no change in forest structure and therefore the opportunity to increase forest structural diversity across the landscape would not be achieved.

Table 20. Alternative 1 Acres of Dense Cover Areas in Treatment Units by CWHR Type and Spotted Owl Nesting and Foraging Habitat within Mechanical Treatment Units

Unit	Emphasis Area	CWHR Type	Dense Cover Areas (Acres)	Not Suitable (Acres)	Nesting (Acres)	Foraging (Acres)
33	1	RFR4D	1.04	0	0	1.04
		SMC4D	0.04	0	0	0.04
	4	RFR4D	0.03	0	0	0.03
		SMC4D	2.92	0	0	2.92
		SMC4M	0.02	0	0	0.02
		SMC3S	0.07	0.07	0	0.00
	5	SMC4D	2.09	0	0	2.09
		SMC4P	0.19	0.19	0	0.00
	6	SMC4D	1.82	0	0	1.82
		SMC4M	0.01	0	0	0.01
		SMC4P	0.02	0.02	0	0.00
34	5	SMC4D	1.43	0	0	1.43
		SMC3P	0.03	0.03	0	0.00
	6	SMC4D	1.36	0	0	1.36
35	1	LPN4D	1.47	1.47	0	0.00
	4	SMC4P	0.58	0.58	0	0.00
	5	SMC4D	0.46	0	0	0.46
		SMC4P	0.02	0.02	0	0.00
	6	SMC4D	0.57	0	0	0.57
		SMC4P	0.46	0.46	0	0.00
36	4	SMC4D	0.98	0	0	0.98
		SMC4M	0.56	0	0	0.56
		SMC4P	0.01	0.01	0	0.00
	5	SMC4D	0.81	0	0	0.81
		SMC4M	0.18	0	0	0.18
	6	SMC4D	0.65	0	0	0.65
		SMC4M	1.24	0	0	1.24
38	1	SMC4D	0.62	0	0	0.62
		SMC4M	0.14	0	0	0.14
		WFR4D	2.69	0	0	2.69

		WFR4M	4.09	0	0	4.09
	5	SMC4M	0.48	0	0	0.48
		SMC4D	2.9	0	0	2.9
		SMC4M	1.06	0	0	1.06
		EPN4S	0.16	0.16	0	0.00
		JPN4P	0.16	0.16	0	0.00
	7	WFR4M	0.22	0	0	0.22
		JPN4P	0.26	0.26	0	0.00
73	4	JPN4D	0.07	0.07	0	0.00
		JPN4M	0.97	0.97	0	0.00
	5	SMC4D	5.08	0	0	5.08
		SMC4M	0.66	0	0	0.66
		JPN4M	0.12	0.12	0	0.00
	6	SMC4D	0.43	0	0	0.43
		JPN4S	0.04	0.04	0	0.00
85	5	JPN3M	0.01	0.01	0	0.00
		JPN4P	0.68	0.68	0	0.00
	6	SMC4D	0.01	0	0	0.01
		JPN3P	0.56	0.56	0	0.00
		JPN4P	1.01	1.01	0	0.05
		JPN4S	0.34	0.34	0	0.00
89	4	SMC4D	0.05	0	0	0.05
		JPN4D	0.26	0.26	0	0.00
		JPN4M	0.07	0.07	0	0.00
		JPN4P	0.16	0.16	0	0.00
		LPN3S	0.07	0.07	0	0.00
	6	JPN4D	1.13	1.13	0	0.00
90	6	SMC4D	1.06	0	0	1.06
		JPN4P	0.07	0.07	0	0.00
156	1	RFR4M	0.67	0	0	0.67
		SMC4D	2.52	0	0	2.52
		WFR4D	1.42	0	0	1.42
		WFR4M	1.5	0	0	1.50
		LPN4D	0.07	0.07	0	0.00
163	1	SMC4M	0.02	0	0	0.02
		WFR4D	4.16	0	0	4.16
	5	SMC4D	2.03	0	0	2.03
		LPN4P	0.69	0.69	0	0.00
213	1	RFR4D	7.82	0	0	7.82

		RFR4M	0.01	0	0	0.01
		SMC4D	4.35	0	0	4.35
		WFR4D	1.42	0	0	1.42
		RFR4P	1.29	1.29	0	0.00
		SMC4P	0.72	0.72	0	0.00
		SMC4S	0.21	0.21	0	0.00
		WFR4S	0.01	0.01	0	0.00
	2	RFR4D	0.3	0	0	0.30
		WFR4D	0.73	0	0	0.73
	4	SMC4D	2.67	0	0	2.67
		ADS	0.4	0.4	0	0.00
	5	SMC4D	0.3	0	0	0.30
	6	SMC4D	0.73	0	0	0.73
		WFR4D	2.67	0	0	2.67
Totals			**81.4**	**12.38**	**0**	**69.07**

Table 21. Alternative 1 Acres of Early Seral Openings in Mechanical Treatment Units by CWHR Type and Suitable Spotted Owl Nesting and Foraging Habitat

Unit	Emphasis Area	CWHR Type	Early Seral Openings (Acres)	Not Suitable (Acres)	Nesting (Acres)	Foraging (Acres)
33	5	SMC4D	1.7	NA	NA	1.7
		SMC4M	0.1	NA	NA	0.1
		SMC3P	0.2	0.2	NA	NA
	6	SMC4D	3.2	NA	NA	3.2
		SMC4M	0.9	NA	NA	0.9
34	5	SMC4D	0.9	NA	NA	0.9
		SMC4D	1.5	NA	NA	1.5
	6	SMC4P	0.5	0.5	NA	NA
	7	SMC4D	0.5	NA	NA	0.5
35	5	SMC4D	0.5	NA	NA	0.5
		SMC4D	1.1	NA	NA	1.1
		SMC4M	0.2	NA	NA	0.2
	6	SMC4P	0.8	0.8	NA	NA
	7	SMC4D	0.3	NA	NA	0.3
36	5	SMC4D	0.4	NA	NA	0.4
	6	SMC4D	1.5	NA	NA	1.5
		SMC4M	1.7	NA	NA	1.7
		JPN4P	0.1	0.1	NA	NA
	7	SMC4D	0.6	NA	NA	0.6

		SMC4M	0.1	NA	NA	0.1
		SMC4P	0.4	0.4	NA	NA
38	1	SMC4D	0.5	NA	NA	0.5
		WFR4D	1.9	NA	NA	1.9
		WFR4M	0.9	NA	NA	0.9
	5	SMC4D	3.8	NA	NA	3.8
		SMC4M	0.3	NA	NA	0.3
	7	SMC4D	1.0	NA	NA	1.0
		SMC4M	0.8	NA	NA	0.8
		WFR4M	0.3	NA	NA	0.3
		JPN4P	0.6	0.6	NA	NA
		SMC4P	0.4	0.4	NA	NA
73	5	SMC4D	2.9	NA	NA	2.9
		SMC4M	1.5	NA	NA	1.5
	6	SMC4D	1.6	NA	NA	1.6
	7	JPN5P	0.5	0.5	NA	NA
85	5	SMC4D	0.4	NA	NA	0.4
	6	SMC4D	0.5	NA	NA	0.5
		JPN3P	0.0	0.0	NA	NA
		JPN4P	1.8	1.8	NA	NA
		JPN4S	0.0	0.0	NA	NA
89	6	JPN4D	1.4	1.4	NA	NA
		JPN4P	0.1	0.1	NA	NA
90	6	SMC4D	1.2	NA	NA	1.2
156	1	SMC4D	0.9	NA	NA	0.9
		WFR4D	0.5	NA	NA	0.5
		WFR4M	0.6	NA	NA	0.6
163	1	WFR4D	1.5	NA	NA	1.5
		LPN4D	0.5	0.5	NA	NA
	5	SMC4D	1.5	NA	NA	1.5
		SMC4M	0.5	NA	NA	0.5
	7	SMC4M	0.5	NA	NA	0.5
213	1	RFR4D	2.7	NA	NA	2.7
		WFR4D	1.6	NA	NA	1.6
		RFR4P	1.3	1.3	NA	0.0
	5	SMC4D	0.7	NA	NA	0.7
		SMC4M	0.3	NA	NA	0.3
	6	SMC4D	0.9	NA	NA	0.9
	7	SMC4D	0.7	NA	NA	0.7
		SMC4M	0.3	NA	NA	0.3
Totals			**54.4**	**8.4**	**0.0**	**46.0**

Snags and Down Logs

Snags and down logs were analyzed in the section *Effects Common to All Wildlife*. Generally, Alternative 1 would maintain all existing snags >15 inch dbh, except for those needing to be removed for equipment operability or those that pose a risk public safety. The Forest Vegetation Simulator model predicted that Alternative 1 would result in lower snag abundance compared to Alternatives 2 and 3 within 30 and 50 years after treatment. Generally, Alternative 2 would result in the most snags compared to Alternatives 1 and 3, 30 and 50 years post-treatment. In all cases, the snag densities projected at 30 and 50 years post-treatment would retain snag densities per Forest Plan standards and guidelines throughout the Sagehen Basin under all the alternatives. As no treatments are proposed within the PAC, all snags and down logs would be retained within the core area that would be needed for roosting and nesting.

Cumulative Effects

Past, present, and reasonably foreseeable future projects and their effects on wildlife habitat, were described in the section *Cumulative Effects Common to All Wildlife,* which also applies to the spotted owl. Past projects' effects on owl habitat are difficult to assess, particularly since the importance of spotted owls on the east side of Tahoe NF and within the Sagehen Basin is not well-understood. Generally, habitat within the analysis area does not provide optimum spotted owl habitat types and conditions when compared to spotted owl distribution on the Tahoe NF. The majority of spotted owl territories on the Forest are located in westside mixed conifer types at lower elevations (i.e. Sierra mixed conifer dominated by ponderosa pine, Douglas fir, white fir, incense cedar, and black oak) with a higher proportion of large tree density and higher canopy cover.

However, the analysis area has been occupied by a single spotted owl territory, since 1998. The vegetation where the territory is located likely represents some of the highest quality late seral habitat within the Basin. It is unknown how this owl territory contributes to the overall owl population on the Tahoe NF as reproductive success of this territory has been uncertain. Perhaps the lack of large, continuous high quality owl habitat limits its reproductive output. It has been suggested that the lack of high quality habitat within the home range of the spotted owl increases home range size, increases energy expenditure, and may lead or contribute to lower reproductive success or fitness. Based on low quality or marginal spotted owl habitat available in the Sagehen area and its location on the eastside of the Sierra Nevada crest, these owls may represent sink populations according to Verner et al. (1992). In general, past timber harvest projects contributed to reducing overall habitat quality and quantity within the analysis area, as well as the conversion of mature forests to early seral forests resulting from the 1960 Donner Ridge Fire.

Vegetation management on both private and Forest Service lands, during the 1980s through the 1990s, resulted in extensive habitat modification of suitable nesting, roosting, and foraging owl habitat from select tree, seed tree, and clearcut harvests. These types of treatments resulted in the removal of approximately 4,729 acres of suitable nesting and foraging habitat (now in an early seral condition). In addition, snag removal during broad-scale salvage operations of the 1990's occurred though out the Basin on over 2,000 acres, which ultimately caused the reduction in available nesting and foraging structures. Past projects (i.e. Sagehen/Spring Chicken Fuelbreaks (576 acres), Liberty/Stampede/Zingara (504 acres), and others for a total of 1,215 acres) that implemented thinning from below rendered suitable habitat quality lowered or in some cases may have been reduced in the amount of nesting and foraging habitat quality in the short-term. Although many of the treatments have since recovered in canopy cover densities and tree size, the structural diversity has been simplified without multi-layered condition in many areas, and without decadent standing and down wood features. Furthermore, significant spotted owl nesting and roosting habitat was likely lost from wildfires including the stand-replacing 1960 Donner Ridge Fire (9,587 ac), 1960 unnamed fire (46 ac), 1968 Sagehen Fire (152 ac), and the 1926 Independence Fire (2,653 acres).

This section will focus specifically on cumulative effects of the Sagehen Project alternatives combined with the effects of past, present, and reasonably foreseeable future activities on suitable spotted owl nesting and foraging habitat by changes to CWHR habitat types from treatment effects. For specific project descriptions, refer to the section on *Cumulative Effects to All Species*.

Past regeneration harvests (662 acres on Forest Service lands and an estimated 4,443 acres on private lands) resulted in long-term reductions in moderate quality nesting, roosting, and foraging habitat (change to unsuitable habitat). While the not every acre harvested comprised this high quality habitat prior to harvest, one can assume that a moderate proportion of the harvested area would have been occupied by larger trees and had higher canopy cover levels characteristic of suitable nesting and roosting habitat. While high quality nesting habitat was likely removed from these regeneration harvests of the past, the amount and quantity of high quality nesting habitat (CWHR 5M, 5D, 6) that was affected was likely dependent on the distribution of vegetation types within and surrounding the Basin. Areas that were dominated by more open eastside pine types were not likely preferred for nesting by owls. Whereas, areas that were historically comprised of true fir types were likely to provide larger trees and denser canopy cover levels that are suitable for nesting. Present and future projects would not result in the loss or reduction in the quantity of nesting/roosting habitat. The Independence THP (19 ac) and Transition Project (14 ac) would reduce suitable nesting habitat quality on 33 acres in the short-term from the reduction in canopy cover, however no changes to tree size class would occur. The Sagehen Project action alternatives would not contribute to adding cumulative effects to suitable spotted owl nesting habitat, as none of the treatments are proposed within suitable owl nesting habitat (CWHR 5M, 5D, 6). Given the overall low habitat quality and relatively lack of suitable nesting habitat within the Basin and analysis area, cumulatively affecting 32 (<0.1%) acres would likely be inconsequential to spotted owls considering there is only one spotted owl territory within the 29,467-acre analysis area. In addition, both the Transition and Independence Lake projects are in the northern portion of the analysis area located several miles from the known spotted owl territory.

Past project treatments (Sagehen/Spring Chicken Fuelbreaks, Liberty, Zingara, Stampede, and others) resulted in the reduction in the quality of spotted owl foraging habitat within the analysis area. For the most part, those treatments have likely recovered in canopy cover to pre-treatment levels. However, depending on the intensity of treatments, some areas may still have very open understories, such as the fuelbreaks or defensive fuel profile zones and may be lacking dead and down wood. Approximately 982 acres from present and future projects would reduce the quality of spotted owl foraging habitat in the short-term, but would not result in the loss of foraging habitat as shown in Table 22. Alternative 1 and 3 would cumulatively add 1,280 and 112 acres, respectively to past, present, and reasonably foreseeable future actions that have reduced the quality of owl foraging habitat. Under Alternative 1, current unit average canopy cover ranges from 51% to 80% and post-treatment average canopy cover would range from 41% to 71%. The average unit canopy cover for Alternative 3 currently ranges from 51% to 76%. Average canopy cover for the units following treatments under Alternative 3 would range from 41% to 71%. Alternative 2, no action, would not add to existing cumulative effects to the spotted owl or its habitat within the analysis area. However, forest resiliency, forest heterogeneity, and reduced fuels hazard would not be achieved under the no action alternative. While there are a number of past, present, and future projects resulting in short-term reductions in the quality of suitable foraging habitat, the additional short-term reductions under the action alternatives would not result in substantial adverse cumulative effect on foraging habitat, particularly since no foraging habitat would be removed.

<table>
<tr><th colspan="9">Table 22. Present and Reasonably Foreseeable Future Cumulative Effects to Spotted Owl Nesting and Foraging Habitat</th></tr>
<tr><th rowspan="2">Projects</th><th rowspan="2">Project Acres in Analysis Area</th><th colspan="3">Nesting Habitat</th><th colspan="3">Foraging Habitat</th><th rowspan="2">Cumulative Effect</th></tr>
<tr><th>Acres</th><th>Pre-Treatment CWHR Type</th><th>Post-Treatment CWHR</th><th>Acres</th><th>Current CWHR</th><th>Post-Treatment CWHR</th></tr>
<tr><td>Sagehen</td><td>2,654</td><td>0</td><td>None</td><td>None</td><td>1,280 (Alt 1)
112 (Alt 3)</td><td>See Tables 17 & 18</td><td>See Tables 17 & 18</td><td>No suitable nesting habitat affected. Short-term reduction in foraging habitat quality on 1,280 acres for Alternative 1 and 112 acre for Alternative 3.</td></tr>
<tr><td rowspan="2">Billy Grunt</td><td rowspan="2">179.5</td><td rowspan="2">0</td><td rowspan="2">None</td><td rowspan="2">None</td><td>20.67</td><td>EPN4D</td><td>EPN4M</td><td rowspan="2">No Suitable nesting habitat in project area. No loss of foraging habitat, but reduction in canopy cover going from 4D to 4M on 21 acres; 5 ac 4M staying 4M</td></tr>
<tr><td>4.73</td><td>EPN4M</td><td>EPN4M</td></tr>
<tr><td rowspan="2">Billy Mastication</td><td rowspan="2">1648.3</td><td rowspan="2">0</td><td rowspan="2">None</td><td rowspan="2">None</td><td>68.5</td><td>EPN4D</td><td>EPN4M</td><td rowspan="2">No loss of foraging habitat, but reduction in canopy cover going from 4D to 4M on 69 acres; 55 acres reduced canopy but staying in same WHR canopy class 4M</td></tr>
<tr><td>55.1</td><td>EPN4M</td><td>EPN4M</td></tr>
<tr><td>Dry Creek</td><td>194.3</td><td>0</td><td>None</td><td>None</td><td>0</td><td>None</td><td>None</td><td>No suitable owl nesting and foraging; no effect</td></tr>
<tr><td rowspan="2">Independence THP</td><td rowspan="2">610.5</td><td>3.1</td><td>WFR5D</td><td>WFR5M</td><td>161.1</td><td>(SMC, RFR, WFR) 4D</td><td>(SMC, RFR, WFR) 4M</td><td rowspan="2">No reduction in suitable owl habit; reduced habitat quality on 18 ac nesting and 287 ac foraging habitat, change in WHR canopy class on 3 ac nesting and 161 ac foraging where WHR canopy class changes from D to M</td></tr>
<tr><td>15.5</td><td>WFR5M</td><td>WFR5M</td><td>126.1</td><td>(SMC, RFR, WFR) 4M</td><td>(SMC, RFR, WFR) 4M</td></tr>
<tr><td>Outback</td><td>5.9</td><td>0</td><td>None</td><td>None</td><td>0.15</td><td>EPN4D</td><td>ASP4P or ASP3P</td><td>Type conversion from EPN TO ASP, insignificant impact to spotted owl habitat due to such small acreage affected</td></tr>
</table>

Phoenix (Lira and Koruna)	562.2	0	None	None	17.7	(EPN, WFR) 4D	(EPN, WFR) early seral opening	No effect to suitable nesting habitat (none in analysis area)~18 ac of EPN4D/4M foraging habitat converted to early seral opening, overall unit will remaining suitable foraging; Overall no loss in suitable owl foraging, but reduction in foraging quality where canopy class moved from 4D to 4M and 36 acres of EPN4M will stay EPN4M
					0.7	(EPN, WFR) 4M	(EPN, WFR) early seral opening	
					265.9	(EPN, WFR) 4D	(EPN, WFR) 4M	
					35.6	(EPN, WFR) 4M	(EPN, WFR) 4M	
Transition	1038.4	13.6	EPN6D	ENP6M	80.1	(EPN, WFR) 4D	(EPN, WFR) 4M	No reduction in suitable owl habit; reduced habitat quality on 13.6 ac nesting and 222 ac foraging habitat, change in CWHR canopy class on 13.6 ac nesting and 80 ac foraging where canopy CWHR canopy class changes from D to M, no change in canopy class on 142 acres but will have a reduction in overall canopy cover
					142.1	(EPN, WFR) 4M	(EPN, WFR) 4M	
					3.9	EPN4M (underburn only)	EPN4M	
Totals	**4,245.0**	**32.2**			**982.4**			

California Spotted Owl: Conclusion and Determination

THE SNFPA is a "Conservation strategy for old forest and associated species…(designed) to provide environmental conditions that are likely to maintain viable populations of old forest associated species, most specifically the California spotted owl, well-distributed across Sierra Nevada national forests. The strategy seeks to maintain existing suitable California spotted owl habitat to stabilize current population declines" (SNFPA ROD Appendix A page 1). The proposed Sagehen Project would implement the spotted owl SNFPA S&Gs by retaining suitable habitat through the retention of large trees, canopy cover >40%, and protect and create snags and down logs.

Habitat modeling has been used to project the effects of forest treatments on spotted owls and their habitat. Simulation modeling suggests that landscape-scale fuels treatments on a small proportion of the landscape can minimize effects to owl habitat and reduce risk of habitat loss to wildfire (Ager et al. 2007, Lehmkuhl et al. 2007 in Keane 2013). Some treatments may also reduce fire risk within core areas with minimal effects on owl reproduction (Lee and Irwin 2005). Habitat modeling indicates that the reduction of wildfire risk in the long-term may benefit spotted owls while having short-term effects on spotted owl habitat (Roloff et al. 2012 in Keane 2013). Results from modeling also suggests that fuels treatments can be effectively used to reduce wildfire risk and support restoration efforts while providing spotted owl habitat at home range and landscape scales. Hence, it would follow that while short-term impacts to spotted owl and their habitat from modifying 1,280 acres (Alternative 1) and/or 112 acres (Alternative 3) are expected, spotted owls within the Sagehen Basin would likely be benefited in the long-term by the reduction of high severity wildfire risk. The actual response of spotted owls to these types of treatments is uncertain, and therefore monitoring or studies to better understand spotted owl response to these types of treatments can better inform how owls respond to these types of treatments.

Additionally, the Sagehen Project uses concepts from GTR-220 and GTR-237 which strives to promote long-term ecosystem restoration, forest resiliency, and fuels reduction while using innovative vegetation treatments that enhances and retains suitable spotted owl habitat at the PAC and HRCA scale and within suitable habitat across the analysis area. North (2012) suggests that because owls use a variety of habitats for foraging and nesting, forest heterogeneity across the landscape can improve spotted owl viability. The Sagehen Project, as proposed, would:

- Maintain suitable nesting, roosting, and nesting habitat within the PAC and HRCA and within suitable nesting and foraging habitat across the 29,467-acre analysis area. No treatments within the PAC are proposed for any of the action alternatives.

- Retain high and moderate quality nesting and roosting habitat dominated by large trees, moderate to high canopy cover, abundance of snags and downed logs , and therefore promote spotted owl occupancy and reproductive success, given the limited amount of high quality spotted owl habitat within the Basin.

- Maintain and create habitat for spotted owl for prey species, particularly, Northern flying squirrels, deer mice, pocket gophers, and other small mammals through various treatments, including dense Cover Areas , early seral openings, snag creation, and retention of shrubs.

- Promote forest resiliency and patch-scale heterogeneity to meet fuels and ecological restoration objectives while providing for spotted owl habitat

- Forest management and fuels reduction strategies uses slope, topographic position and aspect that would result under a natural disturbance regime may outweigh the short-term impacts of spotted owl habitat alteration

It is my determination that implementation of Alternatives 1 and 3 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the California spotted owl within the planning area of Tahoe National Forest. In the absence of a range wide viability assessment, this viability determination is based on local knowledge of the California spotted owl as discussed previously in this evaluation, and professional judgment.

GREAT GRAY OWL

Status: USFS R5 Sensitive

A. Great Gray Owl: Existing Environment

The great gray owl is listed on the USFS R5 Sensitive Species List for Tahoe National Forest. The distribution of the great gray owl is circumpolar, with the Sierra Nevada encompassing the most southern extent of the species (Beck and Winter 2000). The core range of the great gray owl in California is centered on the greater Yosemite National Park area (Winter 1986, Greene 1995, Beck and Winter 2000, Sears 2006). There are records of great gray owls as far south as Tulare County, and to the north from the Modoc, Lassen, Plumas, Tahoe, and Eldorado National Forests, and from Del Norte, Humboldt, Shasta, and Siskiyou Counties (Beck and Winter 2000).

Current knowledge on great gray owl distribution and habitat requirements is somewhat limited, in part because research and surveys are difficult due to the wary and elusive behavior of the species (Sears 2006, Rognan 2007). There is a possibility that they will be found occupying additional locations where there is suitable habitat. Winter (1986) estimated the population in the greater Yosemite area at 73 birds in 1984, and Greene (1995) estimated over 100 birds (of all age classes) in the same area. Sears (2006) estimated 123 individuals throughout the Sierra Nevada based upon surveys to the northern and southern extent of their expected distribution and accounting for the previous estimates for the Yosemite area.

In the Sierra Nevada, great gray owls have been found to require two particular habitat components; a meadow system with a sufficient prey base, and adjoining forest with adequate cover and nesting structures (Winter 1980, Winter 1986, Greene 1995, van Riper and van Wagtendonk 2006). Meadows appear to be the most important foraging habitat for great gray owls, where approximately 93% of their prey is taken (Winter 1981). Data from the greater Yosemite area suggests that to support persistent occupancy and reproduction, meadows need to be at least 25 acres, but meadows as small as 10 acres may support infrequent breeding (Winter 1986, Beck and Winter 2000). Using radio telemetry, van Riper and van Wagtendonk (2006) found that over 60% of all great gray owl locations were within 100 m (328 ft.) of a meadow; 80% of locations were within 200 m (656 ft) of a meadow. In their radio telemetry study, only twice did van Riper and van Wagtendonk (2006) locate great gray owls at distances greater than 1000 m (0.62 mile) from a meadow. Great gray owls have been documented in northeastern Oregon foraging in open forest, clear-cuts, and burned areas where these areas support a high cover (eg. mean 88% in forest with canopy cover 11-59%) grass-forb habitat (Bull and Henjum 1990), but these habitats in the Sierra Nevada, including oak savannah, appear to provide sub-optimal foraging habitat and may be used by floaters (Greene 1995). In comparing number of large snags (>24" dbh), smaller snags (<24" dbh), and canopy cover, Greene (1995) found that high canopy cover was the only variable significantly higher in occupied habitat, possibly due to its effect on microclimate.

In the Sierra Nevada, great gray owl breeding activity is generally found in mixed coniferous forest from 2,500 to 8,000 feet elevation where such forests occur in combination with meadows or other vegetated openings (Greene 1995, Beck and Winter 2000). In their study in Yosemite National Park, van Riper and van Wagtendonk (2006) found that home ranges were located adjacent to meadows in red fir and Sierra mixed conifer most frequently, and home range boundaries followed meadow and drainage topography. They found that most females nested where red fir was the most common habitat type, and some nested in habitat dominated by lodgepole pine (van Riper and van Wagtendonk 2006). Habitat types used by breeding females included Sierra mixed conifer, montane riparian, and montane chapparal types (van Riper and van Wagtendonk 2006). Nesting usually occurs within 840 feet (averaging 500 feet) of the forest edge and adjacent open foraging habitat (Beck and Winter 2000). Greene (1995) found that nest sites had greater canopy closure (mean 84%) and were more likely located on northern aspects than expected by chance.

As with most owls, great gray owls do not build their nests (Bull and Henjum 1990, Greene 1995). In contrast to northeastern Oregon and elsewhere where platforms such as old hawk nests and mistletoe infected limbs are the predominant nest substrate (Bull and Henjum 1990), most nests in the Sierra Nevada have generally been found at the top of large broken top fir snags; fir snags tend to break at right angles and form a suitable nest substrate (Winter 1986, Greene 1995). Greene (1995) found that the next most preferred species for nesting was black oak, found at the lower elevations. Greene (1995) found that nest trees in Stanislaus National Forest averaged 32" dbh and 32 ft tall, while those in Yosemite National Park averaged 44" dbh and 45 ft tall. Greene (1995) suggests that a site may be occupied as long as there is at least one suitable large broken top snag for nesting, finding no correlation with occupied reproductive habitat and number of snags. In Stanislaus National Forest, numerous artificial nest structures which simulate broken topped snags have been created by topping large trees and hollowing out a nest bowl, and many have been used for nesting (Greene 1995). In northeastern Oregon, Bull and Henjum (1990) found that great gray owls readily used artificial open platforms, preferentially 49 feet high but also 30 feet high if none higher were available, and preferentially in closed forested stands versus those adjacent to clear-cuts.

In the Yosemite area, males begin establishing nesting territories in March to early April (Beck 1985). After 30 to 36 days of incubation, eggs hatch from mid May to mid June. Young begin to fledge in early June to early July, but will remain around the nest through August. However, great gray owls will breed earlier at higher elevations (approximately 2 weeks earlier for every 1,000 foot increase in elevation).

In Yosemite National Park, van Riper and van Wagtendonk (2006) found breeding season home ranges (95% adaptive kernel) averaged 152 acres for females and 49 acres for males. Breeding adults were found to utilize specific activity centers within the home range, with radio telemetry locations densely packed in localized areas; the activity centers averaged 43 acres (based on the

75% adaptive kernel home range). Activity centers were based around nests or roost sites but also included nearby foraging areas, and were frequently associated with outer meadow boundaries (van Riper and van Wagtendonk 2006). While much larger than breeding season home ranges, non-breeding season home ranges were also centered on wet meadows (van Riper and van Wagtendonk 2006). During the non-breeding season, home ranges averaged 6,072 acres for females and 5,221 acres for males (van Riper and van Wagtendonk 2006).

Great gray owls hunt by perching at the edges of meadows or grasslands and listening for prey in grass runways or underground burrows, then flying low over the ground and dropping on the prey (Brunton 1971, Nero 1969, Winter 1981). During the majority of the breeding season, males do a majority of the hunting, often by day, and provide food to the nest (Greene 1995). Winter (1982) observed that owls at Ackerson Meadow in the Stanislaus NF used a mean perch height of 10.8 feet in trees with an average dbh of 13 inches and that they preferred trees with a dbh larger than 9 inches. Larger trees possibly have more open limb development, allowing stooping and less view obstruction. Winter (1982) also observed owls using fence posts as hunting perches. Greene (1995) found that hunting perches were generally located in drier microsites. Stoop distances observed in Yosemite National Park ranged from 0.98 feet to 213 feet, with a mean of 77.57 feet (Reid 1989). On the Stanislaus NF, the longest stoop distance observed was 200 feet and the average was 29.8 feet (Winter 1982). The lack of perches at the edges and/or within meadows may render a meadow unsuitable for great gray owls.

Prey of great gray owls is primarily pocket gophers and voles (Winter 1986, Reid 1989, Bull et al. 1989). If prey numbers are low in any given year, great gray owls may occupy a site but may not nest possibly due to the lack of ability to feed young (Bull and Henjum 1990). In Yosemite National Park, Reid (1989) found that gophers and voles made up 94.6% of the total biomass of great gray owl pellets, with gopher biomass nearly twice that of voles. Winter (1986) found that gophers and voles represented 81.5% and 13.8%, respectively, of the biomass in pellets. Similarly in northeastern Oregon, Bull et al. (1989) found that pocket gophers and voles made up 67% and 27%, respectively, of the prey biomass in pellets during the breeding season, or 29% and 52%, respectively, of the prey frequency in pellets. Greene (1995) found that occupied and reproductive great gray owl habitat corresponded more closely to greater vole than greater gopher abundance; his results suggested that gophers are generally more abundant than voles, but they are probably less available to great gray owls due to the fact they are typically underground. Pocket gophers tend to inhabit areas of deep unsaturated soils allowing for easier burrowing and tunneling (Jones and Baxter 2004), while voles tend to inhabit wet meadows with thick grass, forbs, and sedge cover (Sera and Early 2003). Greene (1995) found that pocket gophers were primarily sensitive to soil moisture (preferring <10% soil moisture), while voles preferred higher values for vegetation cover, vegetation height, and soil moisture. As increased soil moisture improves habitat for voles, it become less suitable as gopher habitat; in combination with typically drier conditions observed at hunting perch sites, Greene (1995) suggested that variability in soil moisture and related vegetation conditions, to support the two primary prey taxa, may provide optimal great gray owl foraging habitat in the Sierra Nevada.

In Tahoe National Forest, there have been few recorded great gray owl sightings, and nesting has only recently been confirmed in one location on or near private land. Possible sighting and/or detection locations include Perazzo Meadows (May 2004), along Pliocene Ridge Road (occasional sightings since 2003 with confirmed nesting in the area in 2009), three miles north of Nevada City (an adult located in January 1996 and January 1997), Donner Ranch Ski Area (pair observed in November 1994), near Spencer Lakes at the northern border of Tahoe National Forest (detection in

July 1990), south of Lincoln Creek Campground (an individual in July 1987), and near Sattley (pair in January 1985). Surveys conducted by the Forest Service in Tahoe National Forest follow the currently accepted Region 5 protocol (Survey Protocol for the Great Gray Owl in the Sierra Nevada of California (Beck and Winter 2000).

Project Specific Information
Incidental sightings of great gray owls have been reported near the Sagehen Field Station (pers. comm. Jeff Brown). In the spring of 2012, a pair of great gray owls were located by The Nature Conservancy personnel near Independence Lake on land owned by the Nature Conservancy during surveys conducted for the proposed Independence Lake Fuels Reduction Project. The owls were not detected on subsequent follow-up surveys in attempts to locate nesting. An interagency group including, the Nature Conservancy, Forest Service, and CDFW inspected the area where the owls were found and concluded that the area did not conform to what typically would have been considered high quality nesting habitat. Instead the meadow where the owls were located had low growing herbaceous vegetation more typical of dry meadows rather than the wet meadows with dense and tall sedges and grasses. It is suspected that the great gray owls may have been using the area for foraging. Great gray owls are known to have large home ranges (5,000 to 7,000 acres), so it is difficult to know exactly where their nest territory is located, if they are breeding in the vicinity. However, the Independence Creek sightings would be well within the home range of the suspected great gray owl detections at Perazzo Meadows, approximately 5 miles to the northwest. Habitat at Perazzo Meadows is of exceptional high quality for nesting, although thorough survey efforts have been unsuccessful at detecting nesting activities.

Confirmed nesting by great gray owls on the eastside of the Tahoe NF has not been established. The Independence Lake detections are located to the north of the Sagehen Project boundary on the Sierraville RD. Great gray owl surveys were conducted within suitable habitat using the R5 Great Gray Owl Protocol during 2005 and 2006. No detections of great gray owls were found.

Within the Sagehen Basin, suitable great gray owl habitat is located in mature forests surrounding stringer meadows along Sagehen Creek near the Sagehen Field Station and a larger broader meadow/fen system near Sagehen Campground.

B. Great Gray Owl: Effects of the Proposed Action and Alternatives including Project Design Standards

Direct Effects: Great gray owls that may use the Sagehen Project area (potentially for foraging) have the potential to be disturbed or temporarily be displaced by project activities. Project activities would be short-term in duration and would likely be spread across several years, so that, direct effects from disturbance would likely be limited in space and time. Alternative 1 would treat the most acres and therefore would likely pose the greatest risk of disturbance to great gray owls using the area. Alternative 2, no action, would not directly disturb great gray owls.

Indirect Effects: For both Alternatives 1 and 3, treatment within units 98 and 100, located adjacent to suitable meadow habitat, would modify suitable nesting habitat within 300 feet of the meadows. Thinning would reduce canopy cover, but would retain a minimum of 40% canopy cover within treatment units. All existing snags would be retained. Within Unit 100, decadent feature enhancement is proposed which would benefit great gray owls by creating snags that could be used for nesting in the near term. The lack of suitable nesting structures is a limiting factor for great gray owls. Proposed treatments under the action alternatives would provide structural diversity and enhance prey species habitats, while enhancing forest resiliency.

Cumulative Effects: Since great gray owls have not been confirmed to nest within the analysis area, Alternatives 1 and 3 would have a low probability of adding to existing cumulative effects to the great gray owl. It is unknown if the great gray owl historically nested within and adjacent to the Basin. Due to the limited amount of suitable great gray owl habitat that would be affected in treatments (Units 98 and 100), and considering that this species has not been documented to nest in the vicinity, cumulative effects would be minimal to nonexistent.

C. Great Gray Owl: Conclusion and Determination

Great gray owls have not been found to nest within the Sagehen Basin, and therefore, the proposed action alternatives would not affect breeding individuals, or modify suitable breeding habitat.

It is my determination that implementation of Alternatives 1 and 3 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the great gray owl within the planning area of Tahoe National Forest. In the absence of a range wide viability assessment, this viability determination is based on local knowledge of the great gray owl as discussed previously in this evaluation, and professional judgment.

NORTHERN GOSHAWK

Status: USFS R5 Sensitive

A. Northern Goshawk: Existing Environment

The northern goshawk (*Accipiter gentilis)* is listed on the USFS R5 Sensitive Species List for the Tahoe National Forest. In 1997 the northern goshawk was petitioned for listing as threatened or endangered (west of the 100th meridian), but upon status review the USFWS found it did not warrant listing (USFWS 1998; 63 FR 35183).

Standards and guidelines for northern goshawk management are prescribed by the Tahoe National Forest LRMP, as amended. Current guidelines include delineation of protected activity centers (PACs) surrounding all known and newly discovered breeding territories detected on National Forest System lands. Northern goshawk PACs are designated based upon the latest documented nest site and location(s) of alternate nests. If the actual nest site is not located, the PAC is designated based on the location of territorial adult birds or recently fledged juvenile goshawks during the fledgling dependency period (USDA Forest Service 2004).

Northern goshawk PACs are delineated to: (1) include known and suspected nest stands and (2) encompass the best available 200 acres of forested habitat in the largest contiguous patches possible, based on aerial photography. Where suitable nesting habitat occurs in small patches, PACs are defined as multiple blocks in the largest best available patches within 0.5 miles of one another. Best available forested stands for PACs have the following characteristics: (1) trees in the dominant and co-dominant crown classes average 24 inches dbh or greater; (2) in westside conifer and eastside mixed conifer forest types, stands have at least 70 percent tree canopy cover; and (3) in eastside pine forest types, stands have at least 60 percent tree canopy cover. Non-forest vegetation (such as brush and meadows) should not be counted as part of the 200 acres. As additional nest location and habitat data become available, PAC boundaries are reviewed and adjusted as necessary to better include known and suspected nest stands and to encompass the best available 200 acres of forested habitat. When activities are planned adjacent to non-national forest lands, available databases are checked for the presence of nearby northern goshawk activity centers on non-national forest lands. A 200-acre circular area, centered on the activity center, is delineated. Any part of the circular 200-acre area that lies on national forest lands is designated and managed as a northern goshawk PAC. PACs are maintained regardless of northern goshawk occupancy status. PACs may be removed from the network after a stand-replacing event if the habitat has been rendered unsuitable as a northern goshawk PAC and there are no opportunities for re-mapping the PAC in proximity to the affected PAC.

As prescribed by the Tahoe National Forest LRMP, as amended, surveys are conducted in compliance with the Pacific Southwest Region's survey protocols during the planning process when vegetation treatments are likely to reduce habitat quality are proposed in suitable northern goshawk nesting habitat that is not within an existing California spotted owl or northern goshawk PAC. Suitable northern goshawk nesting habitat is defined based on the survey protocol. Surveys conducted in the Tahoe National Forest follow the Survey Methodology for Northern Goshawks in the Pacific Southwest Region, U. S. Forest Service (USDA Forest Service 2000).

In 1999, prior to PAC-delineation guidelines set forth in the 2001 and 2004 SNFPA, 64 Goshawk Management Areas had been identified in Tahoe National Forest based on known nest sites, territorial adults, and habitat suitability. In June 2003, the Tahoe National Forest reviewed existing Goshawk Management Area boundaries to ensure that they met the intent of the SNFPA 2001 direction for goshawk PACs. By June 2003 PAC delineation had been completed in Tahoe National Forest in accordance with SNFPA direction. At that time there were 71 northern goshawk PACs encompassing approximately 15,500 acres. Since then, additional PACs have been delineated based on new information, and as of 2012 there are 127 goshawk PACs in Tahoe National Forest encompassing 27,280 acres.

The Northern Goshawk Scientific Committee was established in 1990 to develop a credible management strategy to conserve the goshawk in the southwestern United States. Reynolds et al. (1992) recommendations included that goshawk nesting home ranges should exist as an interspersed mosaic of various structural stages in certain proportions, and that on every acre within home ranges there should remain a few large trees in clumps that live out their lives and eventually become snags, then logs that decompose. Their recommendations focused on three components of a goshawk's nesting home range, amounting to about 6,000 acres: nest area (approximately 30 acres), post fledging-family area (PFA; approximately 420 acres), and foraging area (approximately 5,400 acres; Reynolds et al. 1992). The nest area may include more than one nest, is typically located on a northerly aspect in a drainage or canyon, and is often near a stream (Reynolds et al. 1992). Nest areas contain one or more stands of large, old trees with a dense canopy cover (Reynolds et al. 1992).

Forest types associated with goshawk nest areas vary geographically (USFWS 1998, Kennedy 2003). In the Sierra Nevada goshawks breed from the mixed conifer forests at low elevations up to and including high elevation lodgepole pine forests and eastside ponderosa pine habitats. Goshawks winter from the lodgepole pine forest down slope to blue oak savannah (Verner and Boss 1980). In the Tahoe National Forest, goshawks are year-round residents. Nests are found in all of the vegetation types listed above, as well as in aspen stands (Tahoe 1999). Andersen et al. (2005), in review of existing research on goshawks including their nesting habitat and typical high canopy closure preferences, noted that high canopy closure in relation to the range of available canopy closure may be more important for goshawk nesting than absolute canopy closure, at least above some minimum threshold.

Many studies have shown that goshawks select more mature forest for nesting, with higher canopy cover and larger trees as compared to surrounding forest (e.g. Hayward and Escano 1989, Squires and Rugiero 1996, Daw and DeStefano 2001). Hypotheses for why goshawks select forest with larger trees and higher canopy cover include: 1) increased protection from predators, 2) increased food availability, 3) reduced exposure to cold temperatures and precipitation during the energetically stressful pre-egg laying period, 4) reduced exposure to high temperatures during the nestling period, 5) reduced competition with raptor species that nest in more open habitats, or 6) increased mobility because of reduced understory vegetation in mature stands (Andersen et al. 2005). Older age coniferous, mixed, and deciduous forest habitats provides large trees for nesting, a closed canopy for protection and thermal cover, and open spaces allowing maneuverability below the canopy (Fowler 1988). Analysis of vegetative data collected at 39 nest sites in the Tahoe National Forest and the Lake Tahoe Basin Management Unit indicates that goshawk nest stands in the Tahoe National Forest have a mean canopy closure of 70 percent, 32 large trees per acre (24-49 inch dbh), large amounts of dead and down logs, and slopes less than 15 percent. The most recent research conducted on the Klamath National Forest indicated that when nest occupancy was monitored over subsequent years, re-occupancy of the nest stand was nearly 100 percent for nest clusters that were maintained at a minimum of 200 acres (Woodbridge and Dietrich 1994).

Recommendations in the Southwest Region suggest managing 5,400 acres of foraging habitat per territory (Reynolds et al. 1992). Conclusions from studies in the Sierra Nevada support similar habitat requirements (Hargis et al 1994, Keane and Morrison 1994). Important components of foraging habitat include snags (min. 3/ac. >18" dbh) and logs (min. 5/ac. >12" dbh and > 8' long) for prey base populations (USDA 1991). Management requirements for the California spotted owl are thought to provide adequate quantities of snags and down logs to support goshawk prey species in foraging habitat (Tahoe 1999). Beier and Drennan (1997) found that goshawks selected foraging sites that had higher canopy closure, greater tree density, and greater density of trees greater than 16 inches in diameter. They recommend managing stands for canopy closure values above the prescribed minimum 40%. Primary prey species include small mammals and birds (Verner and Boss 1980, Fowler 1988).

Goshawk nesting activities are initiated in February. Nest construction, egg laying and incubation occur through May and early June. Young birds hatch and begin fledging in late June and early July, and are independent by mid-September.

Potential risk factors to goshawks include effects of vegetation management and wildfire on the amount, distribution, and quality of habitat (USDA Forest Service Pacific Southwest Region 2001a). In the Lake Tahoe Basin Management Unit, Morrison et al. (2011) found that human activity was twice as high within infrequently as compared to frequently occupied goshawk territories, and there was a greater extent of all types of roads and trails within the infrequently occupied territories. While it is not statistically significant, Grubb et al. (1998) noted no discernible change in behavior to logging truck noise as they passed at 500 meters from two active goshawk nests.

Moser and Garton (2009) experimentally tested the effects of clearcutting within goshawk nesting areas on reoccupancy and nesting success for two years following treatments, and found no effects on goshawk reoccupancy, nesting success, or number of fledglings between harvested and unharvested nesting areas. Their model suggested, however, that goshawk breeding area reoccupancy was a function of the amount of potential nesting habitat available in the 17-ha area surrounding the nest, with goshawks reoccupying breeding areas if they contained >39% potential nesting habitat following harvest; and that goshawks were more likely to attempt nesting after disturbance if >39% of the 170-ha (420 acres) area around their nest was left in potential nesting habitat (Moser and Garton 2009). A circular area representing 420 acres would be represented by a radius of approximately 0.4 miles.

Project Specific Information:

Suitable goshawk habitat within the Sagehen Basin has been surveyed to USFS Region 5 Northern Goshawk protocol including historic visits since 1992. There are five Northern goshawk territories located within the Basin. Table 23 displays a summary of goshawk detections and reproductive status from 1992 to present for each PAC. Surveys indicate the five goshawk PACs continue to be occupied as evidenced by reproduction or detection of adults and/or young in recent years. In 2010, the NE Sagehen PAC was discovered.

Table 23. Reproductive Status of Northern Goshawk Territories in the Sagehen Basin

PAC Name (Territory ID)	Year Surveyed	Territory and Reproductive Status
Lower Sagehen (D57T01)	2002	Active: 2 young
	2003	Active: reprod. Status unknown, wail and alarm calls heard
	2005	Active: female and begging calls heard
	2006	Inactive
	2009	Active: 2 young
	2010	Unknown Accipiters detected
	2011	Inactive
	2012	Active: fledgling detected
Upper Sagehen (D57T06)	1992	Active: Nest established, 3 fledglings
	1993, 1994, 1995	Inactive
	2006	Active: pair detected, nest fell down with possible nestling in nest
	2009	Active: adult + 2 nestlings
	2010	Active: nest established with at least 1 nestling
	2011	Unknown: juvenile detected outside of PAC
BGB (D57T21)	2004	Active: Pair detected, reproduction evident by white wash and feathers under nest
	2005	Active: 2004 nest not used; goshawk heard east of 2004 nest site
	2006	Active: reprod. status unknown, adult detected
	2009	Active: pair detected, nest not found

	2010	Inactive
	2011	Inactive
	2012	Active: 1 juvenile detected
NE SAGEHEN (D57T23)	2011	Active, New nest found, 1 fledgling
	2012	Active, original nest in disrepair, food begging call heard, indicating potential reproduction
Switchback (D57T22)	2004	Active: female and 2 nests found
	2005	Active: adult response
	2006	Active: pair
	2009	Active: adult + 1 fledgling
	2010	Active: adult + 2 fledglings
	2011	Active: 2 fledglings
	2012	Active: 2 nestlings

Suitable Goshawk Nesting and Foraging Habitat Description and Analysis Area

Suitable goshawk habitat for analyzing the direct, indirect, and cumulative effects project alternatives was generated by modeling habitat using the current Tahoe NF vegetation map and Geospatial Interface tools for ArcGIS. The existing vegetation maps are classified using the CWHR classification system. Suitable goshawk habitat for this project used the goshawk habitat suitability ratings from the CWHR Classification System as follows:

Table 24. High and Moderate Quality Northern Goshawk Nesting and Foraging Habitat by CWHR Type, Size Class and Canopy Cover		
High Quality Nesting Habitat		
Forest Type	**Size Class**	**Canopy Cover**
Jeffrey Pine (JPN), Lodgepole Pine (LPN), Montane Riparian (MRI), Montane Hardwood Conifer (MHC), Montane Hardwood (MHW), Ponderosa Pine (PPN), Sierra Mixed Conifer (SMC), Subalpine Conifer (SCN), White Fir (WFR),	4, 5, 6	M, D
Red Fir (RFR)	6, 5	M, D
Moderate Quality Nesting Habitat		
Aspen (ASP), Douglas Fir (DFR),	4, 5, 6	M, D
Eastside Pine (EPN)	3, 4, 5, 6	M, D
Lodgepole Pine (LPN), Subalpine Conifer (SCN)	3	M,D
High Quality Foraging Habitat		
Douglas Fir (DFR), Eastside Pine (EPN), Jeffrey Pine (JPN), Lodgepole Pine (LPN), Ponderosa Pine (PPN), Montane Hardwood (MHW), Montane Hardwood Conifer (MHC), Montane Riparian, Sierra Mixed Conifer (SMC), Subalpine Conifer (SCN), White Fir (WFR)	4, 5, 6; 5, 6	M, D; S, P
Red Fir (RFR)	5, 6	S, P, M, D

Moderate Quality Foraging Habitat		
Aspen (ASP)	3, 4, 5, 6; 4	M, D; S, P
Douglas Fir (DFR)	3 4	M,D; S, P
Eastside Pine (EPN), Jeffrey Pine (JPN), Lodgepole Pine (LPN), Montane Hardwood (MHW), Montane Hardwood Conifer (MHC), Montane Riparian, Ponderosa Pine (PPN), Sierra Mixed Conifer (SMC), Subalpine Conifer (SCN), White Fir (WFR)	2, 3; 2, 3, 4	M, D; S, P
Red Fir (RFR)	3, 4; 4, 5	M, D; S, P

Within the Sagehen Wildlife analysis area, there is a total of 29,467 acres of which 75% (22,237 ac) is on National Forest System lands (NFS) and 25% (7,230 ac) is in private ownership (Table 25). Of the total National Forest System lands in the analysis area, 31% is suitable high quality nesting, roosting, and foraging goshawk habitat; 16% is suitable moderate quality nesting habitat; 37% is moderate and high quality foraging habitat; and 16% is not suitable, based on the CWHR suitability criteria as shown in Table 24.

Table 25. Acres of Suitable Goshawk Nesting and Foraging Habitat within Wildlife Analysis Area by Ownership

Habitat Suitability	Analysis Area Acres	Forest Service			Private		
		Acres	% Habitat FS lands (22,237)	% FS Habitat Analysis Area (29,467 ac)	Acres	% Habitat PVT lands (7,230 ac)	% PVT Habitat Analysis Area (29,467 ac)
High Quality Nesting, Roosting, and Foraging	8,885	6,820	31%	23%	2,065	29%	7%
Moderate Quality Nesting	4,050	3,585	16%	12%	464	6%	2%
Moderate and High Quality Foraging	10,849	8,263	37%	28%	2,586	36%	9%
Not Suitable	5,683	3,568	16%	12%	2,115	29%	7
Total	**29,466**	**22,236**	**100%**	**75%**	**7,230**	**100%**	**25%**

Table 25 displays the acres of suitable goshawk habitat by CWHR vegetation type, tree size class and canopy cover on Forest Service and private lands within the analysis area. The amount and type of suitable habitat in Table 25 reflects the existing current condition and for Alternative 2, No Action.

Table 25. Northern Goshawk Habitat Suitability and CWHR Type, Size, and Canopy Cover by Ownership within the Analysis Area

CWHR Type	Tree Size	Canopy Cover	Forest Service (Acres)	Private (Acres)
High Quality Nesting, Roosting, and Foraging Habitat				
EPN	6	D	13.6	0.0
JPN	4	D	1,426.5	10.0

JPN	4	M	1,072.4	293.3
JPN	5	D	0.7	34.1
JPN	5	M	72.5	39.7
LPN	4	D	488.7	10.6
LPN	4	M	187.1	51.9
LPN	5	D	1.7	0.0
LPN	5	M	0.0	54.0
LPN	6	D	3.6	2.6
MRI	4	D	4.7	3.2
MRI	4	M	10.3	1.2
RFR	5	D	16.6	6.6
RFR	5	M	152.7	103.7
RFR	6	D	63.1	13.4
SCN	4	M	54.8	25.3
SCN	5	M	10.3	0.0
SMC	4	D	1,481.0	16.9
SMC	4	M	615.3	128.1
SMC	5	D	5.3	45.3
SMC	5	M	14.8	28.4
SMC	6	D	2.1	7.0
WFR	4	D	503.5	283.7
WFR	4	M	454.8	449.5
WFR	5	D	74.2	73.9
WFR	5	M	33.6	368.3
WFR	6	D	56.3	13.5
Total			**6,820.2**	**2,064.2**
Moderate Quality Nesting, Roosting, and Foraging Habitat				
EPN	3	D	309.1	0.0
EPN	3	M	175.1	2.7
EPN	4	D	826.9	9.0
EPN	4	M	888.2	71.3
EPN	5	D	5.0	0.0
EPN	5	M	64.8	8.6
LPN	3	D	182.1	0.0
LPN	3	M	32.9	0.0
RFR	4	D	536.2	79.8
RFR	4	M	565.1	293.0
Total			**3,585.5**	**464.4**
High and Moderate Quality Foraging Habitat (Not Included in Nesting Habitat Above)				
EPN	2	D	20.2	0.0
EPN	2	M	22.1	0.0

EPN	2	P	100.3	0.0
EPN	2	S	242.8	4.7
EPN	3	P	319.7	0.0
EPN	3	S	232.8	0.0
EPN	4	P	1,492.5	80.7
EPN	4	S	757.8	57.4
EPN	5	P	70.9	0.1
EPN	5	S	15.9	0.0
JPN	2	D	9.6	0.0
JPN	2	M	12.8	0.0
JPN	2	P	57.3	0.0
JPN	2	S	125.8	0.0
JPN	3	D	256.0	0.0
JPN	3	M	374.4	1.0
JPN	3	P	82.2	0.0
JPN	3	S	126.1	4.2
JPN	4	P	1,184.1	156.0
JPN	4	S	403.5	75.0
JPN	5	P	39.7	18.5
JPN	5	S	12.8	0.0
LPN	3	P	59.9	0.0
LPN	3	S	20.0	3.0
LPN	4	P	170.2	47.8
LPN	4	S	77.0	4.6
LPN	5	P	20.8	27.5
LPN	5	S	0.0	6.2
MRI	2	M	0.0	87.1
MRI	3	P	0.0	5.2
MRI	4	P	4.5	16.5
RFR	3	D	19.2	0.0
RFR	3	P	21.3	142.8
RFR	4	P	384.7	440.0
RFR	4	S	214.8	155.0
RFR	5	P	37.3	97.3
RFR	5	S	0.0	7.3
SCN	4	P	7.3	54.3
SCN	4	S	13.7	13.1
SCN	5	P	16.5	8.3
SMC	3	D	14.0	0.0
SMC	3	M	17.4	0.0
SMC	3	P	29.2	0.5

SMC	3	S	62.1	16.6
SMC	4	P	373.8	40.9
SMC	4	S	88.4	9.5
SMC	5	P	125.2	107.1
SMC	5	S	24.9	61.3
WFR	2	D	16.3	0.0
WFR	2	S	27.2	0.0
WFR	3	M	22.1	0.0
WFR	3	P	20.3	11.1
WFR	3	S	32.6	75.5
WFR	4	P	244.5	507.5
WFR	4	S	121.3	183.1
WFR	5	P	5.7	24.8
WFR	5	S	12.0	34.5
Total			**8,262.9**	**2,585.8**

Figures 4 and 5 depicts maps of Northern goshawk suitable nesting, roosting, and foraging habitat including proposed treatments for the proposed action.

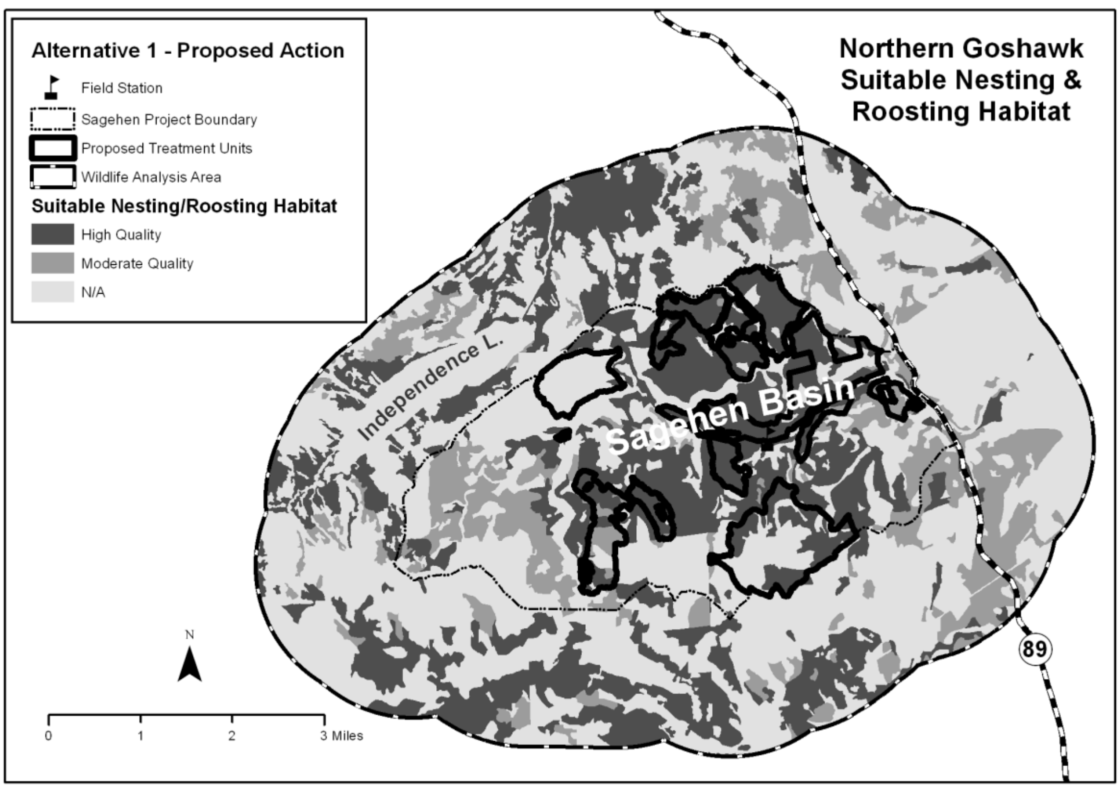

Figure 4. Suitable Goshawk Nesting and Roosting Habitat and Proposed Action Treatment Units

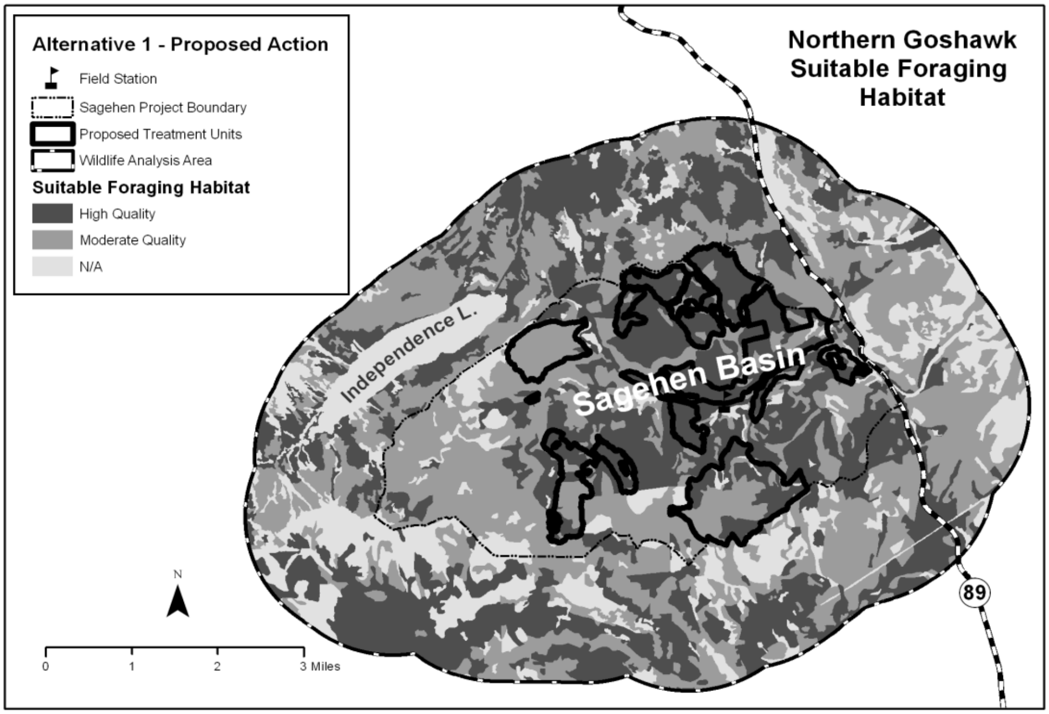

Figure 5. Suitable Goshawk Foraging Habitat and Proposed Action Treatment Units

B. Northern Goshawk: Effects of the Proposed Action and Alternatives including Project Design Standards

Assumptions used for the analysis:

- Adult goshawk survivorship is positively correlated to the amount of mature forests (mid to late-successional forests)
- Goshawk owl territory occupancy is positively related to the amount of mature forest within the 200-acre Protected Activity Center
- High quality nesting and roosting habitat dominated by large trees, moderate to high canopy cover, abundance of snags and downed logs is related to goshawk occupancy and reproductive success
- Goshawk foraging habitat encompasses a broader range of vegetation conditions compared to nesting and roosting habitat, and is likely related to the availability and abundance of prey species, such as birds, jack rabbits, ground squirrels, deer mice, pocket gophers, and other small mammals
- Forest management aimed at promoting forest resiliency and patch-scale heterogeneity can meet fuels and ecological restoration objectives and provide for goshawk habitat (North et al. 2009, North et al. 2012)
- Forest management and fuels reduction strategies using slope, topographic position and aspect that would result under a natural disturbance regime may benefit goshawk by reducing the risk of stand-replacement wildfires, although short-term impacts to habitat would be expected

Direct Effects – Project Disturbance

Five Northern goshawk nest territories are located within the Sagehen Basin. Project-level noise and disturbance from treatment activities have the potential to disturb and disrupt nesting goshawk within the project area. In order to minimize direct project effects, a limited operating period from February 15 to September 15 for Units 33, 34, 35, 36, 38, 39, and 163. This LOP may be modified by the wildlife biologist if surveys determine nesting will not be affected within ¼ mile of the proposed activities.

Indirect Effects - Habitat Quantity and Quality

Indirect effects to goshawk abundance and distribution can be affected by habitat alteration from treatment activities that affect canopy cover density, forest structure, understory condition, and availability of large trees. The availability of snags and down logs is also important to consider within goshawk and their prey species habitats. Additionally, broken snags and logs provide important structures used for plucking prey species, such as birds and small mammals.

The indirect effects of the project alternatives to goshawk nesting and foraging habitat will be described at two spatial scales: 1) the PAC and 2) the Sagehen Project Wildlife Analysis Area. The metrics or considerations for analyzing indirect effects are as follows:

- Changes to CWHR Type, Size Class, and Canopy Cover
- Snags and Downed Log Abundance
- Habitat Fragmentation and Structural Diversity
- Forest Resiliency

Indirect Effects to Goshawk Protected Activity Centers (PAC)

The Sierra Nevada Forest Plan Amendment Record of Decision (SNFPA ROD 2004) directed the Sierra Nevada national forests to designate Protected Activity Centers surrounding all known and newly discovered breeding territories detected on National Forest System lands. PAC boundaries include known and suspected nest stands and encompass the best available 200 acres of forested habitat. Within the Sagehen Basin there are five goshawk nesting territories: Lower Sagehen PAC (D57T01), Upper Sagehen PAC (D57T06), BGB PAC (D57T21, NE Sagehen PAC (D57T23), and Switchback PAC (D57T22).

Figure 7 displays the PACs within the analysis area and the proposed treatment units under Alternative 1, the Proposed Action.

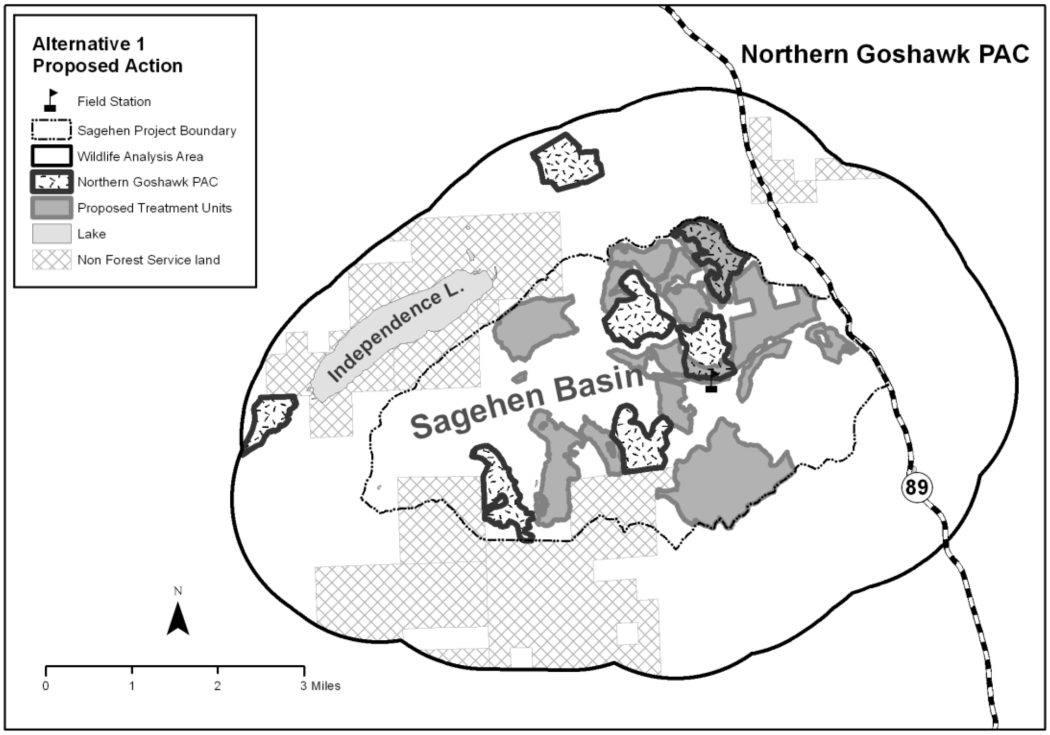

Figure 7. Northern Goshawk PACs and Proposed Action Treatment Units

Amendments to the Forest Plan

Northern Goshawk Protected Activity Centers: Existing Forest Plan direction for fire and fuels management relative to goshawk PACs includes the following: "Avoid PACs to the greatest extent possible when locating area treatments." Furthermore, the Forest Plan provides management direction (S&Gs 71, 72, 73, 74) for mechanical treatments within PACs.

Standard and guideline 71 provides direction on choices about which PACs to enter, when treatment areas must intersect PACs, using criteria to preferentially avoid PACs that have the highest likely contribution to owl productivity. Table 26 displays the goshawk PACs and rankings for their relative contribution to productivity with 1 being the lowest and 5 being the highest. A ranking of 1 would have the highest priority for treatment, and a ranking of 5 would have the lowest priority for treatment.

Table 26. Goshawk PACs and their Contribution to Productivity Ranking for Treatments

Goshawk PAC Name and Territory ID	Contribution to Productivity*
Lower Sagehen PAC (D57T01)	5
Upper Sagehen PAC (D57T06)	5
BGB PAC (D57T21)	5
NE Sagehen PAC (D57T23)	5
Switchback PAC (D57T22)	5

*1) Lowest contribution to productivity: PACs presently unoccupied and historically occupied by territorial singles only, 2) PACs presently unoccupied and historically occupied by pairs, 3) PACs presently occupied by territorial singles, 4) PACs presently occupied by pairs, and 5. Highest contribution to productivity: PACs currently or historically reproductive

All the goshawk PACs in the Basin rank as the "highest contribution to productivity" as all have had reproduction in recent years and therefore should have a lower priority for treatment, according to the Forest Plan. However, the NE Sagehen PACs is proposed for mechanical treatments, and therefore, the Forest Plan would need to be amended to allow treatments within this PAC.

No mechanical treatments are proposed within Upper Sagehen, BGB, or Switchback goshawk PACs under Alternatives 1, 2, 3, and therefore, there would be no indirect effects of habitat alteration within these PACs. This would be consistent with Forest Plan direction to "avoid mechanical treatments within PACs." Additionally, the Lower Sagehen PAC would also be consistent with Forest Plan direction standard and guideline #72 which states "Mechanical treatments may be conducted to meet fuels objectives in PACs located in WUI defense zones…" since, this PAC is just north of the Sagehen Field Station, and is located within the WUI defense zone.

The NE Sagehen Goshawk PAC falls entirely within the WUI threat zone. Forest Plan direction (standard and guideline 72) states "In PACs located in WUI threat zones, mechanical treatments are allowed where prescribed fire is not feasible and where avoiding PACs would significantly compromise the overall effectiveness of the landscape fire and fuels strategy. Mechanical treatments should be designed to maintain habitat structure and function of the PAC." Alternative 1 proposes to mechanically treat the NE Sagehen PAC as part of the landscape fire and fuels strategy. However, a Forest Plan amendment is needed because Alternative 1 proposes treatments that go beyond a fire and fuels strategy, utilizing concepts from GTR-220 and GTR-237 (North et al. 2009, North et al. 2012), with the specific objectives to improve wildlife habitat for mature forest associated species, such as the goshawk. These treatments include forest management aimed at promoting forest resiliency and patch-scale heterogeneity for fuels and ecological restoration objectives. Specific proposed treatments include legacy tree treatments to promote the development and growth of larger trees; variable thinning, early seral openings, and dense cover areas to promote forest heterogeneity; and decadent feature enhancements to increase snag densities.

Standard and guideline 73 states, "Treatments in the remainder of the PAC (outside of the 500-foot radius buffer) use the forest-wide standards and guidelines for mechanical thinning." Forest Plan direction for mechanical thinning treatments within PACs states, "where treatment is necessary, remove only material needed to meet project fuels objectives. Focus on removal of surface and ladder fuels." As previously stated, proposed treatments for the NE Sagehen PAC, go beyond objectives for fuels hazard reduction, and therefore a Forest Plan Amendment is needed. Otherwise proposed mechanical thinning treatments within the NE Sagehen PAC would conform to Forest Plan direction (S&G 6, 7, 8).

Indirect effects to the Lower Sagehen PAC and the NE Sagehen PAC are described.

<u>Lower Sagehen Goshawk PAC</u>
The Lower Sagehen PAC falls within the WUI defense zone, where hand thinning is proposed for Unit 282 under Alternatives 1 and 3. WUI defense zones are the areas in closest proximity to communities, areas with higher densities of residences, commercial buildings, and/or administrative

sites with facilities. The Sagehen Field Research Station lies within the WUI defense zone adjacent to the Lower Sagehen PAC. Out of a total of 108 acres proposed for thinning in Unit 282, approximately 54 acres of suitable goshawk nesting habitat and 2 acres of suitable foraging habitat would be hand thinned. With the exception of 3 acres, 51 acres would retain the current CWHR canopy classification. Three acres of suitable nesting habitat would change from CWHR 4D to 4M, where the canopy cover would fall below 60%. All of the 54 acres of suitable nesting habitat would remain suitable following thinning treatments. Two acres of foraging habitat would not change in canopy cover classification. Overall, canopy cover would change from a unit average of 76% to 59% for unit 282 where fuels where the risk to wildfires would be lowered while maintaining suitable habitat conditions for the goshawk under both Alternatives 1 and 3.

<u>NE Sagehen Goshawk PAC</u>

In 2011, an active goshawk nest with one fledgling was discovered, necessitating the designation of a new northern goshawk protected activity center (PAC). This PAC, known as the NE Sagehen goshawk PAC, encompasses all of Unit 39 (32 acres) and those portions of Unit 38 within emphasis areas 1, 4, and 5 (160 acres). The emphasis area 7 portions of Unit 38 (50 acres) are not within the PAC. Under Alternative 1, a portion of this PAC (160 acres in Unit 38) is proposed for mechanical thinning followed by prescribed underburning.

Alternative 1 proposes to amend the Forest Plan by implementing proposed treatments within the NE Sagehen Goshawk PAC, since the Forest Plan provides directs the Sierra Nevada forests to only conduct treatments needed to meet fuels objectives. Proposed treatments within the PAC would go beyond simply meeting fuels objectives and would be beneficial to goshawk and their habitats by also increasing forest structural diversity, create snags, and promote resilient forests conditions, in addition to reducing fuels hazards. The creation of early seral openings would potentially improve goshawk prey species habitat by regenerating and enhancing shrub species abundance. Legacy tree treatments would also reduce fuels, but would specifically be aimed at developing larger trees.

The NE Sagehen Goshawk PAC lies entirely within the WUI threat zone, where mechanical treatments proposed under Alternative 1 include variable thinning, legacy tree treatment, suppressed cut, decadent feature enhancement, dense cover areas, early seral openings, and underburning. The implementation of Alternative 1 would treat 132 acres of nesting habitat and 7 acres of foraging habitat (Table 27). Out of 132 acres of suitable nesting habitat, 93 acres would change from CWHR 4D to 4M post-treatment, and 39 acres of CWHR 4M would stay 4M post-treatment. Thinning treatments within Unit 38 would change canopy cover from 71% to 50.3% resulting in the short-term reduction in habitat quality. The core area of the PAC lies within Unit 39, and this unit is no longer proposed for treatment under any of the alternatives. Hence, the existing canopy cover of 71 percent in Unit 39 would be retained. The average residual canopy cover within the entire PAC, including Units 38 and 39 combined would be 53.4%. Suitable goshawk habitat post-treatment would not result in the loss of suitable habitat. Understory vegetation would become more open from thinning treatments and underburning, which would provide more open forest conditions preferred for hunting by goshawk. Legacy tree treatments would promote the growth of larger trees which would provide more nesting structures. Decadent feature enhancements would enhance prey habitat and goshawk roosting/resting habitat by increasing the abundance and distribution of snags. Overall, when considered together, all the various treatments including delineating dense cover areas and creation of early seral openings would provide increased horizontal and vertical diversity that would be beneficial to goshawk for nesting and foraging in the long-term.

The NE Goshawk PAC would not be treated under Alternatives 2 and 3, and therefore indirect impacts to goshawk habitat would not occur as described under Alternative 1. However, the opportunity to develop more resilient forests, increase structural diversity, create snags, and reduce wildfire risk to protect and enhance goshawk habitat within the PAC would be foregone. Alternative 3 would have slightly greater benefits than Alternative 2, since 56 acres of suitable habitat within the Lower Sagehen PAC would receive fuels treatments.

Table 27. Acres of CWHR Type Changes to Northern Goshawk Nesting and Foraging Habitat from Thinning Treatments

Alternative 1 Only

NE Sagehen Goshawk PAC

Unit	Unit Acres	Mechanical Thinning Treatment Acres	Nesting Habitat				Foraging Habitat				Unit Average Canopy Cover	
			Nesting Habitat Acres	Current CWHR Type, Size and Canopy Cover	Post-Treatment CWHR Type, Size and Canopy Cover	Acres Change in Canopy Class	Foragi ng Habita t Acres	Current CWHR Type, Size and Canopy Cover	Post-Treatment Size and Canopy Cover	Acres Change in Canopy Cover Class	Curren t	Post-Treatment
38	210	177	93	SMC/WFR4D	SMC/WFR4M	93	3	JPN/SMC4P	JPN/SMC4P	0	71%	50%
			39	SMC/WFR4M	SMC/WFR4M	0	4	EPN4S	EPN4S	0		
Total			132			93	7			0		

Alternatives 1 and 3

Lower Sagehen Goshawk PAC

Unit	Unit Acres	Hand Thinning Treatment Acres	Nesting Habitat				Foraging Habitat				Unit Average Canopy Cover	
			Nesting Habitat Acres	Current CWHR Type, Size and Canopy Cover	Post-Treatment CWHR Type, Size and Canopy Cover	Acres Change in Canopy Class	Foraging Habitat Acres	Current CWHR Type, Size and Canopy Cover	Post-Treatment Size and Canopy Cover	Acres Change in Canopy Cover Class	Current	Post-Treatment
282	108	108	20	JPN4D	JPN4D	0	2	JPN4P	JPN4P	0	76%	59%
			3	JPN/SMC4D	JPN/SMC4M	3	0.2	JPN4S	JPN4S	0		
			31	JPN/LPN4M	JPN/LPN4M	0						
Total			54			3	2.2					

Dense Cover Areas and Early Seral Openings within Goshawk PACs

As described in the proposed action, dense cover areas (DCAs) are small areas distributed within treatment units that provide continuous vertical and horizontal cover with a mixture of shrubs and trees along with large and small down wood, snags, and high stumps. DCAs would typically contain clumps of trees of various size classes as well as a variety of snag and down wood sizes. These DCAs, ranging in size from 0.25-1 acre, would contribute to/enhance within-stand horizontal and vertical structural diversity and provide important old forest and/or mid seral habitat elements within the HRCA.

ESOs would be comprised of dense young regenerating trees and/or shrubs to provide early successional habitat within larger stands managed for late successional or old forest habitat. ESOs, from 0.25-0.50 acre, would enhance within-stand age and species diversity. ESOs would be created by taking advantage of existing conditions, such as areas of sparse tree cover, thinner soils, or pockets of extensive tree mortality. Openings would be created by removing most or all of the existing trees and either planting or allowing natural shrub and/or tree regeneration to create an ESO of early successional habitat. Within ESOs (regeneration areas), prescribed fire would be applied to regenerate shrubs and create suitable areas for shade-intolerant tree species to regenerate.

For DCAs comprised of multiple sizes of trees, snags, and down wood, prescribed fire would be carefully applied to maintain key habitat elements, particularly snags and down wood. Underburning in DCAs comprised of multiple sizes of trees, snags, and down wood would likely result in some mortality of suppressed and subdominant trees. Burning prescriptions would be designed to ensure the overall structure of the DCA would remain intact.

Table 28 displays the distribution and acres of DCAs and ESO's within proposed treatment units located within the NE Sagehen Goshawk and the Lower Sagehen Goshawk PACs and shows the changes to CWHR type for Alternatives 1 and 3. Under Alternative 1, approximately 19 acres of DCAs within the PACs would be designated for retention (13 acres – Unit 38, 6 acres – Unit 282) and would continue to provide areas of higher canopy, vertical and horizontal structure, down wood, snags, and high stumps in their existing condition. The 7 acres of ESOs scattered across Unit 38 in the PAC would result in removal of all existing trees and would eventually be planted or naturally regenerate over time. Therefore, the CWHR vegetation class in ESOs would likely remain the same as the current existing vegetation following treatment. However, the CWHR tree size and canopy classes would be reverted to early seral openings following treatments, as all trees would be removed. However, it is expected that the ESOs would eventually become forested and not result in long-term type conversion. Additionally, the ESOs would not alter or change the habitat suitability for Northern goshawk across the units or would not result in habitat fragmentation at the landscape level. These DCAs and ESOs combined with variable thinning, legacy tree treatments, suppressed thinning, and associated fuels treatments would result in a more diverse and resilient landscape within and surrounding the PACs, although localized effects from the treatments would vary depending upon the size of the openings and site-specific conditions. Generally, the creation of early seral openings would be expected to result in increased shrubs, which would benefit prey species diversity. The overall effects to both the NE Sagehen Goshawk and the Lower Sagehen Goshawk PACs would be minimal, since the openings are small and scattered.

Alternative 1 would provide more structural diversity within the NE Sagehen PAC by the delineation of both DCAs and ESOs scattered throughout the 210 acres of Unit 38 compared to both Alternatives 2 and 3. Under Alternative 3, Non-commercial Alternative, a total of 6 acres of DCAs are proposed within Unit 282 (108 acres) where hand thinning is proposed. There would be no ESO treatments proposed within the Lower Sagehen PAC for Alternatives 1 and 3. For Alternative 2, No Action, there would be no implementation of DCAs or ESO and the PACs would remain in the existing condition and would not provide for increased vegetation structural and age class diversity across the 210-acre PAC.

Table 28. Acres of Dense Cover Areas and Early Seral Openings and Changes to CWHR Types Within NE Sagehen Goshawk PAC

Unit	Unit Acres	Emphasis Area	Emphasis Area Acres	Treatment Type	Method	Fuels Treatment	Total DCA/ESO Acres	Current CWHR	Currently Suitable (Y/N)	Post-treatment CWHR	Suitable Post-treatment (Y/N)
Alternative 1											
38	210	1	67	Dense Cover Area	No Harvest Area	Underburn	3.3	SMC/WFR4D	y	SMC/WFR4D	y
							4.1	WFR4M	Y	WFR4M	Y
				Early Seral Opening	Mechanical		2.4	SMC/WFR4D	Y	SMC/WFR - Early Seral Openings	N
							0.9	WFR4M	Y	WFR – Early Seral Openings	N
		4	7	Dense Cover Area	No Harvest Area		0.5	SMC4M	Y	SMC4M	y
		5	86	Dense Cover Area	No Harvest Area		2.9	SMC4D	Y	SMC4D	Y
							1.5	SMC4M	Y	SMC4M	Y
				Early Seral Opening	Mechanical		3.8	SMC4D	Y	SMC – Early Seral Openings	N
							0.3	SMC4M	Y	SMC – Early Seral Openings	N
		7	50	Dense Cover Area	No Harvest Area		0.2	WFR4M	Y	WFR4M	Y
Total	210		210				19.9				
Alternatives 1 and 3											
282	108	2	46	Dense Cover Area	No Harvest Area	Underburn	2.5	SMC4D	y	SMC4D	y
		6	62	Dense Cover Area	No Harvest Area		3.5	SMC4D	y	SMC4D	y
Total	108		108				6.0				

Indirect Effects to Suitable Goshawk Owl Habitat

Suitable goshawk foraging and nesting habitat were assessed for potential effects of proposed treatments for the action alternatives (Table 29). Under Alternative 1, 1,792 acres of suitable nesting habitat and 798 acres of foraging habitat are proposed for thinning out of the total 2,653 acres. In addition, 64 acres would be treated that are not suitable for foraging or nesting. Of the 1,792 acres of suitable nesting habitat, thinning and fuels treatments, including variable thinning, legacy tree treatments, and suppressed cutting would result in 881 acres of CWHR 4D that would change to 4M, where canopy cover would be reduced below 60%. Within Unit 33, 35 acres would change from 4D to 4P and 17 acres would change from 4M to 4P where canopy cover would fall below 40% within the Emphasis Area, but the overall residual canopy cover for Unit 33 would be above 40% following treatments. A total of 292 acres would result in retaining canopy cover >60% (3D, 4D, 5D) post-treatment and another 581 acres would remain in the 4M canopy class (40-50%). All 1,792 acres of suitable nesting habitat would retain nesting habitat suitability, but would be reduced in quality in the short-term. Within 822 acres of suitable foraging habitat, canopy cover would be reduced, but would remain suitable and would retain their present canopy cover classification following treatments. Current unit average canopy cover ranges from 51% to 80% and post-treatment average canopy cover would range from 41% to 71%.

Under Alternative 3, Non-commercial Alternative, a subset of Alternative 1 units would be proposed for treatment to meet fuels objectives, where 1,132 acres of suitable nesting habitat would result in lowered canopy cover in the short term. All 1,132 acres would remain suitable, but habitat quality would be lowered in the short-term. Approximately 168 acres of nesting habitat would retain canopy cover levels >60%, 187 acres of nesting habitat would change in CWHR type 4D to 4M, and 349 acres would remain as CWHR 4M following treatments. The quantity of suitable foraging habitat would remain unchanged following hand thinning treatments and follow-up fuels treatments such as, prescribed fire and mastication where treatment involves removal of small diameter trees that would not result in a significant change in canopy cover or tree class.

Under Alternative 3, the opportunity to increase and enhance forest resiliency and structure diversity would not be achieved on 1,521 acres that are proposed for treatment under Alternative 1. The average unit canopy cover for Alternative 3 currently ranges from 51% to 76%. Average canopy cover for the units following treatments would range from 41% to 71%.

Under Alternative 2, No Action, 2,653 acres suitable nesting and foraging habitat would not be treated and therefore, canopy cover would not change or be reduced in quality. However, forest resiliency, forest structural diversity, and reduced fuels hazard would not be realized under the No Action Alternative. Stand density reduction would not occur and therefore, legacy tree treatments that would promote the growth and protection of large, old trees important for nesting would not occur. In the long-term, goshawk nesting and foraging habitat, including those within and surrounding the five goshawk PACs, would remain at a higher risk of potentially severe wildfire effects under the No Action Alternative.

Table 29. Changes to CWHR Type within High and Moderate Quality Nesting, Roosting, and Foraging Goshawk Habitat by Unit							
Alternative 1							
Unit	Unit Acres	High and Moderate Quality Nesting			Moderate Quality Foraging		
		Acres	Current CWHR	Post-Treatment CWHR	Acres	Current CWHR	Post-Treatment CWHR
33	118	6.9	SMC/RFR4D	SMC/RFR4D	0.4	SMC3S	SMC3S
		38.3	SMC4D	SMC4M			
		35.2	SMC4D	SMC4P	3.0	SMC3P	SMC3P
		17.1	SMC4M	SMC4P			
		8.5	SMC4M	SMC4M	4.3	SMC4P	SMC4P
		1.1	RFR4D	RFR4D			
		3.6	RFR4D	RFR4M			
34	68	2.8	LPN/SMC4D	LPN/SMC4D	6.3	SMC4P	SMC4P
		58.0	SMC4D	SMC4M			
		1.0	SMC4M	SMC4M			
35	64	2.5	LPN4D	LPN4D	25.0	JPN/SMC4P	JPN/SMC4P
		24.8	LPN/SMC4D	LPN/SMC4M			
		10.9	SMC4M	SMC4M			
36	101	2.4	SMC4D	SMC4D	11.4	JPN/SMC4P	JPN/SMC4P
		44.6	SMC4D	SMC4M			
		48.2	SMC4M	SMC4M			
38	210	6.2	SMC/WFR4D	SMC/WFR4D	4.7	EPN4S	EPN4S
		108.4	SMC/WFR4D	SMC/WFR4M			
		59.9	SMC/WFR4M	SMC/WFR4M	24.4	JPN/SMC4P	JPN/SMC4P
39	32	21.5	SMC4D	SMC4D	4.7	SMC4P	SMC4P
		5.7	SMC4M	SMC4M			
46	621	88.3	JPN/LPN4D	JPN/LPN4M	19.6	JPN2S	JPN2S

					2.4	SMC3S	SMC3S
					7.6	JPN3P	JPN3P
		236.3	JPN/LPN4M	JPN/LPN4M	27.8	JPN/WFR3M	JPN/WFR3M
					31.6	EPN/JPN4S	EPN/JPN4S
					184.8	EPN/JPN/WFR4P	EPN/JPN/WFR4P
47	33	0.9	JPN4D	JPN4M	1.0	JPN3P	JPN3P
					24.8	EPN/JPN4S	EPN/JPN4S
		3.4	JPN4M	JPN4M	3.2	EPN/JPN4P	EPN/JPN4P
61	20	19.8	LPN/WFR4D	LPN/WFR4D	0.0	N/A	N/A
73	144	5.6	JPN/SMC4D	JPN/SMC4D	1.7	JPN4S	JPN4S
		77.3	JPN/SMC4D	JPN/SMC4M			
		36.8	JPN4M	JPN4M	6.0	JPN4P	JPN4P
76	91	2.8	JPN/LPN/SMC4D	JPN/LPN/SMC4M	6.1	EPN3S	EPN3S
		20.9	JPN/SMC4M	JPN/SMC4M	1.0	EPN3P	EPN3P
		0.5	LPN3D	LPN3M	48.5	EPN/JPN4P	EPN/JPN4P
80	5	4.9	SMC4D	ASP4M	0.2	SMC4P	ASP4P
85	64	6.4	SMC4D	SMC4M	6.6	JPN3P	JPN3P
					1.1	JPN3M	JPN3M
					3.4	JPN4S	JPN4S
					45.3	JPN4P	JPN4P
					1.0	JPN4P	ASP4P
87	207	0.1	SMC4D	SMC4M	0.4	JPN/SMC3S	JPN/SMC3S
					196.1	JPN3M	JPN3M
		0.1	SMC4M	SMC4M	7.1	JPN4P	JPN4P
89	34	1.4	JPN4D	JPN4D	0.7	LPN3S	LPN3S
		26.0	JPN/SMC4D	JPN/SMC4M			
		3.5	JPN4M	JPN4M	2.2	JPN4P	JPN4P
90	40	1.1	SMC4D	SMC4D	0.8	JPN4P	JPN4P
		34.0	JPN/LPN/SMC4D	JPN/LPN/SMC4M			

		3.8	SMC4M	SMC4M			
91	9	7.2	JPN/LPN/SMC4M	JPN/LPN/SMC4M	0.3	SMC4S	SMC4S
		1.5	LPN4M	LPN4M			
		13.4	LPN3D	LPN3M			
98	63	45.3	LPN/SMC4D	LPN/SMC4D	3.5	JPN3M	JPN3M
					0.3	LPN4S	LPN4S
					0.5	JPN4P	JPN4P
99	67	10.6	LPN4D	LPN4M	2.8	LPN3S	LPN3S
		30.5	EPN4D	EPN4D	0.6	LPN4P	LPN4P
		19.3	LPN/EPN3D	LPN/EPN3M	2.0	EPN/LPN4S	EPN/LPN4S
100	120	37.2	LPN/SMC4D	LPN/SMC4D	0.1	EPN3S	EPN3S
		30.9	LPN/SMC4D	LPN/SMC4M			
		30.0	JPN/SMC4M	JPN/SMC4M	7.4	JPN/LPN4S	JPN/LPN4S
		3.0	LPN3D	LPN3M	9.4	EPN/JPN/LPN4P	EPN/JPN/LPN4P
156	84	4.0	SMC/WFR4D	SMC/WFR4D	4.2	WFR3P	WFR3P
		47.9	LPN/SMC/WFR4D	LPN/SMC/WFR4M			
		21.6	LPN/WFR4M	LPN/WFR4M	3.3	WFR4P	WFR4P
163	82	6.2	SMC/WFR4D	SMC/WFR4D	4.5	LPN4P	LPN4P
		55.9	LPN/SMC/WFR4D	LPN/SMC/WFR4M			
		14.4	SMC4M	SMC4M	0.6	WFR4S	WFR4S
213	268	10.9	LPN/SMC/WFR4D	LPN/SMC/WFR4D	1.6	SMC/RFR4S	SMC/RFR4S
		104.5	LPN/SMC/WFR4D	LPN/SMC/WFR4M			
		21.3	SMC/WFR4M	SMC/WFR4M			
		8.1	RFR4D	RFR4D	36.4	SMC/RFR4P	SMC/RFR4P
		81.9	RFR4D	RFR4M			
		2.9	LPN3D	LPN3M			
282	108	34.8	JPN/LPN/SMC4D	JPN/LPN/SMC4D	1.4	JPN/LPN/SMC4S	JPN/LPN/SMC4S
		17.4	JPN/LPN/SMC4D	JPN/LPN/SMC4M			
		49.6	JPN/LPN4M	JPN/LPN4M	4.6	JPN4P	JPN4P

	2,653	**1791.6**			**798.4**		
Alternative 3							
Unit	Unit Acres	High and Moderate Quality Nesting			Moderate Quality Foraging		
		Suitable Acres	Current CWHR Type	PostTreatment CWHR Type	Acres	Current CWHR	Post-Treatment CWHR
46	621	88.3	JPN/LPN4D	JPN/LPN4M	19.6	JPN2S	JPN2S
					2.4	SMC3S	SMC3S
					7.6	JPN3P	JPN3P
		236.3	JPN/LPN4M	JPN/LPN4M	27.8	JPN/WFR3M	JPN/WFR3M
					31.6	EPN/JPN4S	EPN/JPN4S
					184.8	EPN/JPN/WFR4P	EPN/JPN/WFR4P
47	33	0.9	JPN4D	JPN4M	1.0	JPN3P	JPN3P
		3.4	JPN4M	JPN4M	24.8	EPN/JPN4S	EPN/JPN4S
					3.2	EPN/JPN4P	EPN/JPN4P
61	20	19.8	LPN/WFR4D	LPN/WFR4D	0.0	N/A	N/A
76	91	2.8	JPN/LPN/SMC4D	JPN/LPN/SMC4M	6.1	EPN3S	EPN3S
		20.9	JPN/SMC4M	JPN/SMC4M	1.0	EPN3P	EPN3P
		0.5	LPN3D	LPN3M	48.5	EPN/JPN4P	EPN/JPN4P
91	9	7.2	JPN/LPN/SMC4M	JPN/LPN/SMC4M	0.3	SMC4S	SMC4S
		1.5	LPN4M	LPN4M			
98	63	13.4	LPN3D	LPN3M	3.5	JPN3M	JPN3M
					0.3	LPN4S	LPN4S
		45.3	LPN/SMC4D	LPN/SMC4D	0.5	JPN4P	JPN4P
99	67	10.6	LPN4D	LPN4M	2.8	LPN3S	LPN3S
		30.5	EPN4D	EPN4D	0.6	LPN4P	LPN4P
		19.3	LPN/EPN3D	LPN/EPN3M	2.0	EPN/LPN4S	EPN/LPN4S
100	120	37.2	LPN/SMC4D	LPN/SMC4D	0.1	EPN3S	EPN3S
		30.9	LPN/SMC4D	LPN/SMC4M			

		30.0	JPN/SMC4M	JPN/SMC4M	7.4	JPN/LPN4S	JPN/LPN4S
		3.0	LPN3D	LPN3M	9.4	EPN/JPN/LPN4P	EPN/JPN/LPN4P
282	108	34.8	JPN/LPN/SMC4D	JPN/LPN/SMC4D	1.4	JPN/LPN/SMC4S	JPN/LPN/SMC4S
		17.4	JPN/LPN/SMC4D	JPN/LPN/SMC4M			
		49.6	JPN/LPN4M	JPN/LPN4M	4.6	JPN4P	JPN4P
	1,132	**703.5**			**391.3**		

Table 30 displays a summary of changes to CWHR types for suitable nesting and foraging habitat by treatment units. For Alternative 1, 292 acres would remain unchanged in the CWHR 5D/4D/3D types, 881 acres would change from CWHR 4D to 4M, 35 acres would change from 4D to 4P, 581 acres of 4M types would remain unchanged, and 17 acres would change from CWHR 4M to 4P types. Although Emphasis Area 6 within Unit 33 would reduce canopy cover to 38% post-treatment, the average canopy across the unit would result in a post-treatment canopy cover of 44%, and would therefore meet Forest Plan standards and guidelines for mechanical thinning. All 2,653 acres of suitable goshawk nesting habitat would be reduced habitat quality, as stated above. However, treatments would result in increased structural diversity and forest resiliency through reduced hazard fuels while maintaining large trees and moderate canopy cover required for nesting. On 822 acres of foraging habitat there would be no change in habitat quantity, but would result in slight canopy reductions from hand thinning and fuels treatments. The understory structure would be more open from various fuels treatments which would benefit goshawk prey species in the short-term.

For Alternative 3, 1,132 acres of suitable nesting habitat proposed for treatments would result in 168 acres that would remain as CWHR 5/4/3D, 349 acres would stay as CWHR 4M, and 187 acres would change from CWHR 4D to 4M following treatments, where habitat quality would be reduced. The quantity of suitable nesting habitat would be unchanged post-treatment. On 391 acres of suitable foraging habitat quantity and post-treatment CWHR types would remain unchanged.

Table 30. Acre Summary of Changes to CWHR types within Suitable Northern Goshawk Nesting and Foraging Habitat									
Unit	Unit Acres	High and Moderate Quality Nesting					Moderate Quality Foraging		
		Post-treatment Acres of CWHR Class Unchanged (5/4/3D remaining 5/4D)	Post-treatment Acres of Changes in CWHR Class (4D to 4M)	Post-treatment Acres of Changes in CWHR Class (4D to 4P)	Post-treatment Acres of CWHR Class Unchanged (4M remaining 4M)	Post-treatment Acres of Changes in CWHR Class (4M to 4P)	Post-treatment Acres of CWHR Class Unchanged (3/4P remaining 3/4P)	Post-treatment Acres of CWHR Class Unchanged (2/3/4S remaining 3/4S)	Post-treatment Acres of CWHR Class Unchanged (3M remaining 3M)
33	118	8	41.9	35.2	8.5	17	7.3	0.4	0
34	68	3	58.0	0.0	1.0	0	6.3	0.0	0
35	64	3	24.84	0.0	10.9	0	25	0	0
36	101	2	44.6	0.0	48.2	0	11.4	0	0
38	210	6	108.4	0	59.9	0	24.4	4.7	0
39	32	21	0.0	0.0	5.7	0	29.1	0	0
46	621	0	88.3	0.0	236.3	0	192.5	53.5	28
47	33	0	0.9	0.0	3.4	0	4.2	24.8	0
61	20	20	0.0	0.0	0.0	0	0	0	0
73	144	6	77.3	0.0	36.8	0	6.0	1.7	0
76	91	0	3.3	0.0	20.9	0	49.5	6.1	0
80	5	0	4.9	0.0	0.0	0	0.2	0	0
85	64	0	6.4	0.0	0.0	0	52.9	3.4	1

87	207	0	0.1	0.0	0.1	0	0.0	0.4	196
89	34	45	0.0	0.0	0.0	0	2.2	0.7	0
90	40	1	34.0	0.0	3.8	0	0.8	0	0
91	9	0	13.4	0.0	8.7	0	0.0	0.3	0
98	63	45	0.0	0.0	0.0	0	0.5	0.3	4
99	67	30	29.8	0.0	0.0	0	0.6	2.8	2
100	120	37	33.9	0.0	30.0	0	9.4	7.5	0
156	84	4	47.9	0.0	21.6	0	7.5	0	0
163	82	6	55.9	0.0	14.4	0	4.5	6	0
213	268	19	189.3	0.0	21.3	0	36.4	1.6	0
282	108	35	17.4	0.0	49.6	0	4.6	1.4	0
Total	**2653**	**292**	**880.6**	**35**	**581.1**	**17**	**475.3**	**115.6**	**231**
Alternative 3									
46	621	0	88.3	0.0	236.3	0	192.5	53.5	28
47	33	0	0.9	0.0	3.4	0	4.2	24.8	0
61	20	20	0.0	0.0	0.0	0	0	0	0
76	91	0	3.3	0.0	20.9	0	49.5	6.1	0
91	9	0	13.4	0.0	8.7	0	0.0	0.3	0
98	63	45	0.0	0.0	0.0	0	0.5	0.3	4
99	67	30	29.8	0.0	0.0	0	0.6	2.8	2
100	120	37	33.9	0.0	30.0	0	9.4	7.5	0
282	108	35	17.4	0.0	49.6	0	4.6	1.4	0
Total	**1,132**	**168**	**187.0**	**0**	**348.9**	**0**	**261.3**	**96.7**	**33**

Dense Cover Areas (DCAs) and Early Seral Openings (ESOs) in Suitable Goshawk Habitat

Dense Cover Areas (DCAs) and Early Seral Openings (ESOs) within mechanical treatment units by CWHR types and goshawk habitat suitability for Alternative 1 are displayed in Tables 31 and 32. DCAs are areas that are delineated within treatment areas that will remain intact and provide high to moderate quality goshawk foraging habitat which typically provide areas of higher canopy cover and larger trees compared to the surrounding areas. Alternative 1 proposes to delineate a total of 78 acres of DCAs, of which 0.4 acres are not suitable, 73 acres are high and moderate quality nesting habitat, and 7 acres are moderate quality foraging habitat for the goshawk.

Alternative 1 proposes to create a total of 54 acres of ESOs, of which 48 acres (89%) are high and moderate quality nesting, and 6 acres (11%) are moderate quality foraging habitat for the goshawk. The ESOs would result in removal of all existing trees and would eventually be planted or naturally regenerate over time. Therefore, the CWHR vegetation class in ESOs would likely remain the same as the current existing vegetation following treatment. However, the CWHR tree size and canopy classes would be reverted to early seral openings following treatments, as all trees would be removed. However, it is expected that the ESOs would eventually become forested and not result in long-term type conversion. Additionally, the ESOs would not alter or change the habitat suitability for goshawk across the treatment units or would not result in habitat fragmentation at the landscape level. These DCAs and ESOs combined with variable thinning, legacy tree treatments, suppressed thinning, and associated fuels treatments would result in a more diverse and resilient landscape within suitable goshawk habitat, although localized effects from the treatments would vary depending upon site-specific conditions.

Both Alternatives 1 and 3 would designate a total of 28 acres of DCAs within fuels treatment units (Units 61, 91, 98, 99, 100, 282). Out of 573 acres proposed for fuels treatments in these units, 342 acres (60%) are suitable goshawk nesting habitat and 33 acres (6%) are suitable for foraging. It can be assumed that the DCAs represent a relatively similar proportion of nesting and foraging habitat within the fuels treatment units, since specific habitat data for DCAs within fuels treatment units was not available for this analysis. Under Alternative 3, increased structural diversity from DCAs would only occur across 573 fuels treatment acres compared to the 1,664 acres in Alternative 1 (Units 33, 34, 35, 36, 38, 61, 73, 85, 89, 90, 91, 156, 163, 213, 282) where the combination of DCAs and ESOs would contribute to more resilient forests and heterogeneity across the landscape. Alternative 2 would provide no change in forest structural diversity across the landscape, but would have the least short term impacts to goshawk habitat in the short-term since no ESOs would be created where all the trees would be harvested.

Table 31. Alternative 1 - Acres of Dense Cover Areas in Mechanical Treatment Units by CWHR Type and Goshawk Nesting and Foraging Habitat						
Unit	Emphasis Area	CWHR Type	Dense Cover Areas (Acres)	Not Suitable (Acres)	High and Moderate Quality Nesting (Acres)	Moderate Quality Foraging (Acres)
33	1	RFR4D	1.0	0	1.0	0
		SMC4D	0.0	0	0.0	0
	4	RFR4D	0.0	0	0.0	0
		SMC4D	2.9	0	2.9	0
		SMC4M	0.0	0	0.0	0
		SMC3S	0.1	0	0.0	0.07
	5	SMC4D	2.1	0	2.1	0
		SMC4P	0.2	0	0.2	0
	6	SMC4D	1.8	0	1.8	0
		SMC4M	0.0	0	0.0	0
		SMC4P	0.0	0	0.0	0.02
34	5	SMC4D	1.4	0	1.4	0
		SMC3P	0.0	0	0.0	0.03
	6	SMC4D	1.4	0	1.4	0
35	1	LPN4D	1.5	0	1.5	0
	6	SMC4D	0.6	0	0.6	0
		SMC4P	0.5	0	0.0	0.46
36	4	SMC4D	1.0	0	1.0	0
		SMC4M	0.6	0	0.6	0
		SMC4P	0.0	0	0.0	0.01
	5	SMC4D	0.8	0	0.8	0
		SMC4M	0.2	0	0.2	0
	6	SMC4D	0.7	0	0.7	0
		SMC4M	1.2	0	1.2	0
38	1	SMC4D	0.6	0	0.6	0
		SMC4M	0.1	0	0.1	0
		WFR4D	2.7	0	2.7	0
		WFR4D	4.1	0	4.1	0
	4	SMC4M	0.5	0	0.5	0
	5	EPN4S	0.2	0	0.0	0.16
		JPN4P	0.2	0	0.0	0.16
		SMC4D	2.9	0	2.9	0
		SMC4M	1.1	0	1.1	0
	7	JPN4P	0.3	0	0.0	0.26
		WFR4M	0.2	0	0.2	0
73	4	JPN4D	0.1	0	0.1	0

		JPN4M	1.0	0	1.0	0
	5	JPN4D	0.1	0	0.1	0
		SMC4M	5.1	0	5.1	0
		SMCM	0.7	0	0.7	0
	6	JPN4S	0.0	0	0.0	0.04
		SMC4D	0.4	0	0.4	0
85	5	JPN3M	0.0	0	0.0	0.01
		JPN4P	0.7	0	0.0	0.68
	6	JPN3P	0.6	0	0.0	0.56
		JPN4P	1.0	0	0.0	1.01
		JPN4S	0.3	0	0.0	0.34
		SMC4D	0.0	0	0.0	0
89	4	JPN4D	0.3	0	0.3	0
		JPN4M	0.1	0	0.1	0
		JPN4P	0.2	0	0.0	0.16
		JPN4S	0.1	0	0.0	0.07
		SMC4D	0.1	0	0.1	0
	6	JPN4D	1.1	0	1.1	0
90	6	JPN4P	0.1	0	0.0	0.07
		SMC4D	1.1	0	1.1	0
156	1	LPN4D	0.1	0	0.1	0
		RFR4M	0.7	0	0.7	0
		SMC4D	2.5	0	2.5	0
		WFR4D	1.4	0	1.4	0
		WFR4M	1.5	0	1.5	0
163	1	SMC4M	0.0	0	0.0	0
		WFR4D	4.2	0	4.2	0
	5	LPN4P	0.7	0	0.0	0.69
		SMC4D	2.0	0	2.0	0
213	1	RFR4D	7.8	0	7.8	0
		RFR4M	0.0	0	0.0	0
		RFR4P	1.3	0	1.3	1.29
		SMC4D	4.4	0	4.4	0
		SMC4P	0.7	0	0.7	0.72
		SMC4S	0.2	0	0.2	0.21
		WFR4D	1.4	0	1.4	0
		WFR4S	0.0	0	0.0	0.01
	2	RFR4D	0.3	0	0.3	0
		WFR4D	0.7	0	0.7	0
	4	ADS	0.4	0.4	0.0	0
		SMC4D	2.7	0	2.7	0

	5	SMC4D	0.9	0	0.9	0
	6	SMC4D	0.9	0	0.9	0
		WFR4D	0.0	0	0.0	0
Total			**78.4**	**0.4**	**73.2**	**7.03**

Table 32. Alternative 1 - Acres of Early Seral Openings in Mechanical Treatment Units by CWHR Type and Goshawk Nesting and Foraging Habitat									
Unit	Emphasis Area	Current CWHR	Early Seral Openings (Acres)	Not Suitable (Acres)	High and Moderate Quality Nesting (Acres)	Moderate Quality Foraging (Acres)	Post-Treatment CWHR	Post-Treatment Suitability within ESO	Post-Treatment Suitability across Emphasis Area
33	5	SMC3P	0.2	0	0.0	0.23	RFR - ESO	Not Suitable	Foraging
		SMC4D	1.7	0	1.7	0	SMC - ESO	Not Suitable	Nesting
		SMC4M	0.1	0	0.1	0	SMC - ESO	Not Suitable	Nesting
	6	SMC4D	3.2	0	3.2	0	SMC - ESO	Not Suitable	Nesting
		SMC4M	0.9	0	0.9	0	SMC - ESO	Not Suitable	Nesting
34	5	SMC4D	0.9	0	0.9	0	SMC - ESO	Not Suitable	Nesting
	6	SMC4D	1.5	0	1.5	0	SMC - ESO	Not Suitable	Nesting
		SMC4D	0.5	0	0.5	0	SMC - ESO	Not Suitable	Foraging
	7	SMC4D	0.5	0	0.5	0	SMC - ESO	Not Suitable	Nesting
35	1	SMC4D	0.5	0	0.5	0	SMC - ESO	Not Suitable	Nesting
	6	SMC4D	1.1	0	1.1	0	SMC - ESO	Not Suitable	Nesting
		SMC4M	0.2	0	0.2	0	SMC - ESO	Not Suitable	Nesting
		SMC4P	0.8	0	0.0	0.76	SMC - ESO	Not Suitable	Foraging
	7	SMC4D	0.3	0	0.3	0	SMC - ESO	Not Suitable	Nesting
36	5	SMC4D	0.4	0	0.4	0	SMC - ESO	Not Suitable	Nesting
	6	JPN4P	0.1	0	0.0	0.11	SMC - ESO	Not Suitable	Foraging
		SMC4D	1.5	0	1.5	0	SMC - ESO	Not Suitable	Nesting
		SMC4M	1.7	0	1.7	0	SMC - ESO	Not Suitable	Nesting
	7	SMC4D	0.6	0	0.6	0	SMC - ESO	Not Suitable	Nesting
		SMC4M	0.1	0	0.1	0	SMC - ESO	Not Suitable	Nesting
		SMC4P	0.4	0	0.0	0.37	SMC - ESO	Not Suitable	Foraging
38	1	SMC4D	0.5	0	0.5	0	SMC - ESO	Not Suitable	Nesting
		WFR4D	1.9	0	1.9	0	WFR - ESO	Not Suitable	Nesting

		WFR4M	0.9	0	0.9	0	WFR - ESO	Not Suitable	Nesting
	5	SMC4D	3.8	0	3.8	0	SMC - ESO	Not Suitable	Nesting
		SMC4M	0.3	0	0.3	0	SMC - ESO	Not Suitable	Nesting
	7	JPN4P	0.6	0	0.0	0.6	JPN - ESO	Not Suitable	Foraging
		SMC4D	1.0	0	1.0	0	SMC- ESO	Not Suitable	Nesting
		SMC4M	0.8	0	0.8	0	SMC - ESO	Not Suitable	Nesting
		SMC4P	0.4	0	0.0	0.36	SMC - ESO	Not Suitable	Foraging
		WFR4M	0.3	0	0.3	0	WFR - ESO	Not Suitable	Nesting
73	5	SMC4D	2.9	0	2.9	0	SMC - ESO	Not Suitable	Nesting
		SMC4M	1.5	0	1.5	0	SMC - ESO	Not Suitable	Nesting
	6	SMC4D	1.6	0	1.6	0	SMC - ESO	Not Suitable	Nesting
	7	JPN5P	0.5	0	0.0	0.48	JPN - ESO	Not Suitable	Foraging
85	5	SMC4D	0.4	0	0.4	0	SMC - ESO	Not Suitable	Nesting
		JPN3P	0.0	0	0.0	0.01	JPN - ESO	Not Suitable	Foraging
	6	JPN4P	1.8	0	0.0	1.83	JPN - ESO	Not Suitable	Foraging
		JPN4S	0.0	0	0.0	0.01	JPN - ESO	Not Suitable	Foraging
		SMC4D	0.5	0	0.5	0	SMC - ESO	Not Suitable	Nesting
89	6	JPN4D	1.4	0	1.4	0	JPN - ESO	Not Suitable	Nesting
		JPN4P	0.1	0	0.0	0.05	JPN - ESO	Not Suitable	Foraging
90	6	SMC4D	1.2	0	1.2	0	SMC - ESO	Not Suitable	Nesting
156	1	SMC4D	0.9	0	0.9	0	SMC - ESO	Not Suitable	Nesting
		SMC4D	0.5	0	0.5	0	SMC - ESO	Not Suitable	Nesting
		WFR4M	0.6	0	0.6	0	WFR - ESO	Not Suitable	Nesting
163	1	LPN4D	0.5	0	0.5	0	LPN - ESO	Not Suitable	Nesting
		WFR4D	1.5	0	1.5	0	WFR - ESO	Not Suitable	Nesting
	5	SMC4D	1.5	0	1.5	0	SMC - ESO	Not Suitable	Nesting
		SMC4M	0.5	0	0.5	0	SMC - ESO	Not Suitable	Nesting
	7	SMC4M	0.5	0	0.5	0	SMC - ESO	Not Suitable	Nesting
213	1	RFR4D	2.7	0	2.7	0	RFR - ESO	Not Suitable	Nesting

		RFR4P	1.3	0	0.0	1.31	RFR - ESO	Not Suitable	Foraging
		WFR4D	1.6	0	1.6	0	WFR - ESO	Not Suitable	Nesting
	5	SMC4D	0.7	0	0.7	0	SMC - ESO	Not Suitable	Nesting
		SMC4M	0.3	0	0.3	0	SMC - ESO	Not Suitable	Nesting
	6	SMC4D	0.9	0	0.9	0	SMC - ESO	Not Suitable	Nesting
	7	SMC4D	0.7	0	0.7	0	SMC - ESO	Not Suitable	Nesting
		SMC4M	0.3	0	0.3	0	SMC - ESO	Not Suitable	Nesting
Total			**54.4**	0	**48.3**	**6.12**			

Snags and Down Logs

Snags and down logs were analyzed in the section *Effects Common to All Wildlife*. Generally, Alternative 1 would maintain all existing snags >15 inch dbh, except for those needing to be removed for equipment operability or those that pose a risk public safety. It is expected that there would be no measurable difference in the number of snags greater than 15 inches dbh between the existing condition and the immediate post treatment condition.

The Forest Vegetation Simulator model projected that Alternative 1 would result in lower snag abundance compared to Alternatives 2 and 3 within 30 and 50 years after treatment. Generally, Alternative 2 would result in the most snags compared to Alternatives 1 and 3, 30 and 50 years post-treatment. In all cases, the snag densities projected at 30 and 50 years post-treatment would retain snag densities per Forest Plan standards and guidelines throughout the Sagehen Basin under all the alternatives.

Cumulative Effects

Past, present, and reasonably foreseeable future projects and their effects on wildlife habitat, were described in the section *Cumulative Effects Common to All Wildlife,* which also applies to the Northern goshawk.

Vegetation management on both private and Forest Service lands, during the 1980s through the 1990s, resulted in extensive habitat modification of suitable nesting, roosting, and foraging goshawk habitat from select tree, seed tree, and clearcut harvests. These types of treatments resulted in the removal of approximately 4,729 acres of suitable nesting and foraging habitat (now in an early seral condition). In addition, snag removal during broad-scale salvage operations of the 1990s occurred thoughout the Basin on over 2,000 acres. Past projects (i.e. Sagehen/Spring Chicken Fuelbreaks (576 acres), Liberty/Stampede/Zingara (504 acres), and others for a total of 1,215 acres) that implemented thinning from below rendered suitable habitat quality lowered or in some cases may have been reduced in the amount of nesting and foraging habitat quality in the short-term. Although many of the treatments have since recovered in canopy cover densities and tree size, the structural diversity has been simplified without multi-layered condition in many areas, and without decadent standing and down wood features. Furthermore, significant suitable nesting and foraging habitat was likely altered from wildfires including the stand-replacing 1960 Donner Ridge Fire (9,587 ac), 1960 unnamed fire (46 ac), and 1968 Sagehen Fire (152 ac), and the 1926 Independence Fire (2,653 ac).

This section will focus specifically on cumulative effects of the Sagehen Project alternatives combined with the effects of past, present and reasonably foreseeable future projects on suitable goshawk nesting and foraging habitat by changes to CWHR habitat types from treatment effects. For specific project descriptions, refer to the section on *Cumulative Effects to All Species*.

Past regeneration harvests (662 acres on Forest Service lands and an estimated 4,443 acres on private lands) resulted in long-term reductions in high and moderate quality nesting, roosting, and foraging habitat (change to unsuitable habitat). While the not every acre harvested comprised this high quality habitat prior to harvest, one can assume that a substantial proportion of the harvested area would have been occupied by larger trees and had higher canopy cover levels characteristic of suitable nesting and roosting habitat. While high quality nesting habitat was likely removed from these regeneration harvests of the past, the amount and quantity of high quality goshawk nesting habitat that was affected was likely dependent on the distribution of vegetation types within and surrounding the Basin.

Past project treatments (Sagehen/Spring Chicken fuel breaks, Liberty, Zingara, Stampede, and others) resulted in the reduction in the quality of goshawk foraging habitat within the analysis area. For the most part, those treatments have likely recovered in canopy cover to pre-treatment levels. However, depending on the intensity of treatments, some areas may still have very open understories, such as the fuel breaks or defensive fuel profile zones and may be lacking dead and down wood. Table 31 displays the effects to suitable goshawk nesting and foraging habitat within the 29,467-acre analysis area from present and future vegetation management projects. A total of 3,766 acres of suitable goshawk habitat (2,522 acres nesting habitat, 1,244 acres foraging habitat) would be reduced in quality in the short-term from present and reasonably future projects (i.e. thinning and fuels reduction), but would not result in the reduction in quantity of suitable goshawk habitat as shown in Table 33. The Sagehen Project would add 2,590 acres (nesting - 1,792 acres, foraging - 798 acres) and 1,132 acres (704 acres – nesting, 391 acres – foraging) for Alternative 1 and 3, respectively to past cumulative effects to suitable nesting and foraging goshawk habitat (Tables 29 and 30). Under Alternative 1, current unit average canopy cover ranges from 51% to 80% and post-treatment average canopy cover would range from 41% to 71%. The average unit canopy cover for Alternative 3 currently ranges from 51% to 76%. Average canopy cover for the units following treatments would range from 41% to 71% under Alternative 3.

Alternative 2, No Action, would not add to existing cumulative effects to the goshawk or its habitat within the analysis area. However, forest resiliency, forest heterogeneity, wildlife habitat structural diversity, and reduced fuels hazard would not be achieved under the No Action Alternative. Therefore, long-term threats of wildfire risk to goshawk suitable habitat within and surrounding PACs would not be reduced under Alternative 2.

Table 33. Present and Reasonably Forseeable Future Effects to Northern Goshawk Nesting and Foraging Habitat									
Projects	Project Acres in Analysis Area	High and Moderate Quality Nesting Habitat				Moderate Quality Foraging Habitat (No overlap with Nesting Habitat)			
		Acres	Current CWHR	Post-Treatment CWHR	Cumulative Effect	Acres	Current CWHR	Post-Treatment CWHR	Cumulative Effect
Billy Grunt	179.5	68.5	JPN/LPN4D	JPN/LPN4M	No change in nesting habitat quantity. Short-term reduction in nesting habitat quality on 138 ac				No change in foraging habitat quantity. Short-term reduction in foraging habitat quality on 42 acres
		32.7	JPN/SMC4M	JPN/SMC4M		5.7	JPN3D	JPN3M	
		10.1	EPN3D	EPN3M		8.4	JPN3M	JPN3M	
		1.8	EPN3M	EPN3M		8.4	JPN3M	JPN3M	
		20.7	EPN4D	EPN4M		14.4	EPN/JPN/LPN4P	EPN/JPN/LPN4P	
		4.7	EPN4M	EPN4M		5.3	EPN4S	EPN4S	
Total		**138.5**				**42.2**			
Billy Mass	1648.3	381.9	JPN/LPN/SMC4D	JPN/LPN/SMC4M	No change in nesting habitat quantity. Short-term reduction in nesting habitat quality on 1,046 acres	15.7	WFR2D	WFR2M	No change in foraging habitat quantity. Minimal changes to habitat quality on 374 ac in the short-term. May enhance habitat for some prey species and negatively affect others.
						2.1	EPN2M	EPN2M	
		207.2	JPN/SMC4M	JPN/SMC4M		32.8	EPN2M	EPN2M	
						15.7	WFR2D	WFR2M	
		262.7	EPN3D	EPN3M		2.1	EPN2M	EPN2M	
		82.4	EPN3M	EPN3M		32.8	EPN2M	EPN2M	
						92.8	JPN3P	JPN3P	
		66.3	EPN4D	EPN4M		31.5	JPN3S	JPN3S	
		45.3	EPN4M	EPN4M		148.4	JPN4P	JPN4P	
Total		**1045.7**				**374.0**			
Dry Creek	1648.3	0.0	N/A	N/A	No suitable nesting habitat	3.0	EPN2P	EPN2P	No change in foraging habitat quantity. Minimal changes to habitat quality on 94 ac in the short-term. May enhance habitat for some prey species and negatively affect others.
						8.6	EPN2S	EPN2S	
						6.7	EPN3P	EPN3P	
						39.2	EPN3S	EPN3S	
						25.5	EPN4P	EPN4P	
						10.6	EPN4S	EPN4S	
Total		**0.0**				**93.6**			
Independence Lake THP	610.4	156.0	JPN/LPN/SMC/WFR4D	JPN/LPN/SMC/WFR4 M	No change in nesting habitat quantity. Short-term	5.2	WFR3P	WFR3P	No change in foraging habitat quantity. Minimal changes to habitat quality on 94 ac in the short-term. May
		122.5	JPN/LPN/SMC/WFR4 M	JPN/LPN/SMC/WFR4 M		16.5	JPN/SMC/WFR3S	JPN/SMC/WFR3S	
		3.1	WFR5D	WFR5M					

		15.5	WFR5M	WFR5M	reduction in nesting habitat quality on 346 acres	186.5	JPN/LPNRFRWFR4P	JPN/LPNRFRWFR4P	enhance habitat for some prey species and negatively affect others.
		17.1	RFR4D	RFR4M					
		32.3	RFR4M	RFR4M		25.9	JPN/LPN/RFR/SMC/ WFR4S	JPN/LPN/RFR/SMC/ WFR4S	
Total		**346.4**				**234.2**			
Outback	5.9	2.3	EPN/JPN4D	ASP3P	Conversion from conifer to aspen type. Loss of nesting habita on ~6 acres, but foraging habitat will increase by 5 acres	0.4	EPN/JPN/4P	ASP4P	Enhanced foraging habitat by conversion to aspen type on 0.4 acres.
		3.2	LPN4M	ASP3P					
Total		**5.5**				**0.4**			
Phoenix Project (Koruna and Lira Contracts)	562.26	96.7	JPN/WFR4D	JPN/WFR4M	No change in nesting habitat quantity. Short-term reduction in nesting habitat quality on 450 acres	0.2	EPN3P	EPN3P	No change in foraging habitat quantity. Minimal changes to habitat quality on 106 ac in the short-term. May enhance habitat for some prey species and negatively affect others.
		14.9	JPN/WFR4M	JPN/WFR4M		2.7	EPN/WFR3S	EPN/WFR3S	
		67.9	EPN4D	EPN4D		5.0	WFR4S	WFR4S	
		172.9	EPN4D	EPN4M		93.8	EPN/JPNWFR4P	EPN/JPNWFR4P	
		97.7	EPN4M	EPN4M		4.5	EPN5P	EPN5P	
Total		**450.1**				**106.1**			
Transition	1038.4	2.7	JPN4D	ASP4M	No change in nesting habitat quantity. Short-term reduction in nesting habitat quality on 536 acres	22.9	WFR2S	WFR2S	No change in foraging habitat quantity. Minimal changes to habitat quality on 394 ac in the short-term. May enhance habitat for some prey species and negatively affect others.
		240.9	JPN/WFR4D	JPN/WFR4M		48.3	JPN/W3M	JPN/W3M	
		79.9	JPN/LPN/MRI/WFR4M	JPN/LPN/MRI/WFR4M		42.5	EPN/JPN/WFR3P	EPN/JPN/WFR3P	
		7.9	JPN5M	JPN5M		16.8	EPN/JPN 3S	EPN/JPN 3S	
		6.5	EPN3D	EPN3M		161.7	EPN/JPN/LPN/MRI/ WFR4P	EPN/JPN/LPN/MRI/ WFR4P	
		36.4	EPN3M	EPN3M		72.5	EPN/JPN4S	EPN/JPN4S	
		14.7	EPN4D	EPN4M		8.7	EPN/JPN5P	EPN/JPN5P	
		133.4	EPN4M	EPN4M		20.6	EPN/WFR5S	EPN/WFR5S	
		13.6	EPN6D	EPN6M					
Total		**536.0**				**394.0**			

C. Northern Goshawk: Conclusion and Determination

The Sagehen Project uses concepts from GTR-220 and GTR-237 which strive to promote long-term ecosystem restoration, forest resiliency, and fuels reduction while using innovative vegetation treatments that enhances and retains suitable goshawk habitat across the analysis area. The Sagehen Project, as proposed, would:

- Maintain suitable nesting, roosting, and nesting habitat within the NE Sagehen and Lower Sagehen Goshawk PACs and throughout the treatment units in the long-term. Treatments as proposed under Alternatives 1 and 3 would result in the short-term reduction in habitat quality while promoting long-term sustainability and resiliency of habitat by treatments specifically designed to improve goshawk habitat such as, legacy tree treatment, fuels reduction, increased horizontal and vertical structural diversity, and decadent feature enhancement.
- Retain high and moderate quality nesting and roosting habitat that are dominated by large trees, moderate to high canopy cover, abundance of snags and downed logs, and therefore promote goshawk occupancy and reproductive success.
- Maintain and create habitat for goshawk prey species, particularly, birds and small mammals through various treatments, including dense cover areas , early seral openings, snag creation, and retention of shrubs.
- Promote forest resiliency and patch-scale heterogeneity to meet fuels and ecological restoration objectives while enhancing and maintaining goshawk habitat in the long-term.
- Forest management and fuels reduction strategies uses slope, topographic position and aspect that would result under a natural disturbance regime may benefit goshawk in the long-term, with the acknowledgement that short-term impacts to goshawk may occur.

It is my determination that implementation of Alternatives 1 and 3 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the Northern goshawk within the planning area of Tahoe National Forest. In the absence of a range wide viability assessment, this viability determination is based on local knowledge of the Northern goshawk as discussed previously in this evaluation, and professional judgment.

WILLOW FLYCATCHER

Status: USFS R5 Sensitive

A. Willow Flycatcher: Existing Environment

The willow flycatcher (*Empidonax trailii*) is listed on the USFS R5 Sensitive Species List for Tahoe National Forest. There are three subspecies of willow flycatcher in different portions of California; they have been distinguished from each other based on distribution and color. In the Sierra Nevada, *E. t. adastus* and *E. t. brewsteri* generally occupy the eastern and western slopes, respectively; both of these subspecies likely occur in Tahoe National Forest (Green et al. 2003). The southwestern willow flycatcher, *E. t. extimus*, occupies southern California as well as other southwestern States and was listed as endangered by the USFWS in 1995 (USDI Fish and Wildlife Service 1995; 60 FR 10694).

In accordance with the SNFPA Record of Decision (USDA Forest Service 2001), a Conservation Assessment of the Willow Flycatcher in the Sierra Nevada was completed (Green et al. 2003). The Conservation Assessment summarized all known and relevant information pertinent to management of the willow flycatcher in the Sierra Nevada at the time of its completion. A Conservation Strategy for the Willow Flycatcher in the Sierra Nevada is currently being produced. Willow flycatcher monitoring and demographic analysis has been conducted in the central and northern Sierra Nevada since

1997 under a cost share agreement between Texas A&M University and the USFS Region 5; each year progress reports and a year-end annual report on the results are produced.

The willow flycatcher was once a common summer resident throughout California where suitable habitat existed; areas where it was most common included the Central Valley and central California in general, and the southern coastal region (Grinnell and Miller 1944, Harris et al. 1987). Observed declines in breeding populations have been a growing concern for over four decades and it is now limited to scattered meadows of the Sierra Nevada and along the Kern, Santa Margarita, and San Luis Rey Rivers (Harris et al. 1987). Loss of the willow flycatcher, especially in the Central Valley, has been largely attributed to alteration and loss of riparian habitat by various land management practices along with cowbird parasitism (Harris et al. 1987). As of completion of the Conservation Assessment in 2003, estimates of the willow flycatcher population in the Sierra Nevada bioregion ranged from 300 to 400 individuals, with 120 to 150 individuals on National Forest System land (summarized in Green et al. 2003). Most of the remaining breeding populations of willow flycatchers in the Sierra Nevada occur in isolated mountain meadows up to 8000 feet elevation (Serena 1982, Harris et al. 1988, Stafford and Valentine 1985, Bombay 1999, Bombay et al. 2001). The highest density of territories occurs within the Warner Valley State Wildlife Area in the northern Sierra Nevada, where 50 singing willow flycatchers were detected during 2003 (Bombay et al. 2003). Small populations have also been detected on the Modoc National Forest (Wilson pers. comm. 1994), Mammoth Lake, Lee Vining Creek and Bridgeport Valley (Gaines 1977), and Lundy Canyon (Gaines 1988). The highest recorded number of territories on National Forest System land in the Sierra Nevada bioregion is located in the Perazzo Meadows area in Tahoe National Forest. Systematic surveys and research on willow flycatchers have occurred throughout the Perazzo Meadow area since the early 1980s (eg. Serena 1982, Flett and Sanders 1987, Harris et al. 1987, Sanders and Flett 1989, Bombay et al. 2003, Mathewson et al. 2009).

The willow flycatcher is a small passerine Neotropical migrant that breeds during summer in riparian deciduous shrub habitat generally dominated by willows in the United States and Canada, and winters in tropical and subtropical areas from southern Mexico to northern South America (as summarized in Green et al. 2003). Willow flycatchers in the northern Sierra Nevada typically begin arriving on their breeding grounds around the 1st of June, and egg laying for first nest attempts sometimes begins as early as the second week in June, but more often in late June/early July (summarized in Green et al. 2003). Up to three nesting attempts may occur as a result of nest failure, with egg-laying through the 1st week of August, and all willow flycatchers appear to be gone from their breeding territories by mid-September (summarized in Green et al. 2003).

The following five components may best summarize the collective efforts to describe habitat requirements of the willow flycatcher in the Sierra Nevada (summarized in Green et al. 2003):

- ***Elevation***: Most (88% or 119/135 known sites, at the time of the Conservation Assessment in 2003) Sierra Nevada meadows used by breeding willow flycatchers occur between 4,000 and 8,000 ft. elevation, although meadows as low as 1,200 ft. and as high as 9,500 ft. have been used (Stefani et al. 2001).
- ***Wetness:*** Successful nesting territories are strongly associated with standing or flowing water or heavily saturated soils.
- ***Meadow Size:*** Although use of meadows less than 1 acre has been documented, more than 95% of breeding meadows are greater than 10 acres, and the most successful meadows ($\geq$ 1 territory fledged young) are greater than 15 acres.
- ***Shrub Coverage:*** Riparian deciduous shrub coverage has generally been measured or modeled as a percentage of meadow area; 20 to 30% has been suggested as a minimum for suitable habitat. Scully (1995), however, measured

absolute area and found sites for male willow flycatchers to average 525 m^2. In her habitat suitability index (HSI) model, Scully (1995) gave an optimal coefficient value of 1.0 for shrub patches greater than 400 m^2.

- ***Foliar Density:*** Foliar density is a measure of the riparian deciduous shrub at the 2-meter shrub height level, or the level of the shrub layer where actual nesting generally occurs. Based on her research, Scully (1995) gave a coefficient value of 1.0 for foliar densities of greater than 76 percent in her HSI model.

Breeding habitat typically includes moist meadows with perennial streams and smaller spring fed or boggy areas with willow or alders; dense thickets are generally avoided in favor of more patchy willow sites providing considerable edge (summarized in Green et al. 2003). Bombay et al. (2003) found that riparian shrub cover was the primary predictor of habitat selection at the meadow, territory, and nest site scales, and that increased shrub cover also predicted both abundance and territory success. Willow flycatcher nesting success is strongly associated with standing or flowing water or heavily saturated soils (summarized in Green et al. 2003). Meadow size seems to be an important factor for willow flycatcher use. Willow flycatchers in the Sierra Nevada use meadows ranging from 1 to 719 acres; more than 80% of territories occur in meadows greater than 20 acres (Serena 1982, Harris et al. 1987, Harris et al. 1988, Bombay 1999, Green et al. 2003). Willow flycatchers have also been found in riparian habitats of various types and sizes ranging from small lakes or ponds surrounded by willows with a fringe of meadow or grassland, to willow lined streams, grasslands, or boggy areas.

Male willow flycatchers are territorial during the breeding season. Studies in Tahoe National Forest have found that territory sizes average 0.84 acres (Sanders and Flett 1989). Females may forage outside or at the fringe of the territories defended by males. In addition, after the young fledge the family groups use areas outside of the territories for feeding and cover (M. Flett, pers. comm.). The breeding season begins in late May to early June (Garratt and Dunn 1981) with adults and fledglings generally staying in the breeding areas through August.

Nests are open cupped, usually 3.7 to 8.3 feet above the ground and mostly near the edge of deciduous, riparian shrub clumps (Sanders and Flett 1989, Valentine et al. 1988, Harris 1991). Willow is the most common nest substrate used for breeding in the Sierra Nevada. In Tahoe National Forest, Sanders and Flett (1989) reported that all 20 nests found at two meadows in 1986 and 1987 were located in willows. More recent studies (between 1997 and 2001) in the north-central Sierra Nevada located 250 nests at 15 meadows, of which only 3 nests were in shrubs other than willow: two in alder, and one in dogwood (Morrison et al. 2000, Bombay et al. 2001). Recently, McCreedy and Heath (2004) located willow flycatchers in the rewatered Rush Creek at Mono Lake, where all nine nests found were in wild rose, even though apparently suitable willows were available. The latter is more likely atypical as a result of extreme management activities rather than being typical under "natural" conditions.

Willow flycatchers forage by either aerially gleaning insects from trees, shrubs, and herbaceous vegetation, or they hawk larger insects by waiting on exposed forage perches and capturing them in flight (Ettinger and King 1980, Sanders and Flett 1989). Sanders and Flett (1989) found that in Perazzo Meadows, willow flycatchers usually flew less than 3.3 feet from a perch when hawking insects, but occasionally flew as far as 33 feet. The selection of nest sites near water appears to be related to increased densities of aerial insects. Willow flycatchers feed upon a wide variety of insect and other arthropod prey (Green et al. 2003). They seem to prefer hymenopterids (bees, wasps, and sawflies), dipterids (deer flies and bee flies), moths and butterflies, and small flying beetles. In the Sierra Nevada, hymenopterids and deer flies are particularly important to their diet (as summarized in Green et al. 2003*).* Many studies have found a correlation between insect abundance and hydrologic conditions and riparian vegetation condition (as summarized in Green et al. 2003). Some studies have documented that insect abundance has been linked to bird abundance (as summarized in Green et al. 2003).

Based on demographic analysis of monitoring data from 1997-2008 in the central and northern Sierra Nevada, mean annual nest success (calculated using Mayfield 1961 methodology to account for failed nests prior to them being found) in the central region of the study was 41.2%, and mean annual nest success in Perazzo Meadows was 42.3% (Mathewson et al. 2009). From 1997-2008 in the demography study sites, predation has accounted for 86% of the observed nest failures (Mathewson et al. 2009).

Potential predators of willow flycatcher nests include a variety of mammalian and avian species (Cain et al. 2003), the occurrence of which varies according to environmental characteristics in different portions of meadows (Cain et al. 2006). In the north-central Sierra Nevada, Cain et al. (2003) reported that nest predation was the primary cause of all willow flycatcher nest failures (76%; 22 of 29 nest failures) during their study from 1999-2000; 41% of nests were successful (fledged at least one young; 20 of 49 nests), 45% were depredated (22 of 49 nests), 8% were abandoned (4 of 49 nests), 4% failed due to weather (2 of 49 nests), and 2% were parasitized (1 of 49 nests). Cain et al. (2003) also documented predator species via trip-wired cameras on simulated willow flycatcher nests (zebra finch eggs placed in vacant yellow warbler nests similar to willow flycatcher nests), finding that the photographed predators in order of decreasing prevalence were various chipmunk species (6 nests), Douglas squirrels (4 nests), short-tailed weasels (3 nests), and a deer mouse (1 nest). Douglas squirrel and chipmunk activity decreased substantially as mean meadow wetness increased, and Douglas squirrel activity was negatively correlated with meadow size (Cain et al. 2003). Cain et al. (2003) found the activity indices of the following potential predators or brood parasites negatively associated with willow flycatcher nest success: Douglas squirrels, short-tailed weasels, Clark's nutcrackers, Cooper's hawks, and brown-headed cowbirds. Cain et al. (2006) found Douglas squirrels and chipmunks associated with characteristics common along edges of meadows, short-tailed weasels associated with willows (presumably for protective cover), and mice and long-tailed weasels in a variety of environmental conditions and possibly throughout the meadows. The models they tested suggested that short-tailed weasels may be important predators of the willow flycatcher (Cain et al. 2006).

While brown-headed cowbird parasitism may have been a major contributor to the decline of lowland populations of willow flycatcher, there is less evidence for this in the higher elevations of the Sierra Nevada (Sanders and Flett 1989). In sites monitored in the demography study in the central and northern Sierra Nevada from 1997-2008, mean annual cowbird parasitism rates ranged from 6.8% to 18.4%, depending on the study region and the method of estimating parasitism rates (Mathewson et al. 2009). In the central study area which includes sites in Tahoe National Forest, the maximum mean annual parasitism rate is calculated at 11% (Mathewson et al. 2009).

Potential risk factors include management activities that may affect the current habitat, distribution, and abundance of willow flycatchers in the planning area. Activities that have the potential to alter willow flycatcher habitat including changes to meadow hydrology, stream bank alteration, changes to vegetation structure and composition. Activities that have the potential to affect willow flycatcher habitats are livestock grazing, roads, and recreation that affect meadow/willow systems, such as OHV use.

There are approximately 80 acres of potentially suitable willow flycatcher habitat mapped within the Sagehen Basin located along Sagehen Creek within stringer meadows and willow habitat, extending from Highway 89 to Sagehen Creek Campground. Although, 80 acres of meadow and willow habitat is mapped as potentially suitable for willow flycatchers, not all 80 acres are actually suitable for nesting. An estimated fifty percent of meadow/willow habitat is dryer and does not have standing water at the surface throughout the breeding season that is characteristic of high quality willow flycatcher nesting habitat. The fens at Sagehen have water saturated to the surface throughout the breeding season, including at Mason and Kiln fens. However, the fens have very little willow habitat; and the scattered clumps of willow species found within the fens is the low-growing Eastwood's willow (*Salix eastwoodieae)*, which is not preferred for nesting and foraging by willow flycatcher. In general, willow flycatchers tend to nest and forage in the taller Lemon's willow (*Salix lemmonii*) or Geyer's willow (*Salix geyeriana*), which are found along the mainstem of Sagehen Creek.

The Forest Plan directs the Sierra Nevada Forests to conduct surveys for willow flycatchers within occupied habitat. Willow flycatcher surveys were conducted to Regional protocol between the years of 2001 and 2008. In 2002, a single male was detected in the section between Highway 89 and the Sagehen Field Station. In subsequent years following the 2002 detection, willow flycatchers have not been detected within the Basin.

B. Willow Flycatcher: Effects of the Proposed Action and Alternatives including Project Design Standards

Direct Effects and Indirect Effects.

There is a low potential for willow flycatchers to be directly affected by project activities under Alternatives 1 and 3, since willow flycatchers have not been detected in the vicinity since 2002. Surveys conducted between 2005 and 2008 did not result in locating any willow flycatchers within Sagehen Basin. However, proposed project activities in units that are adjacent to Sagehen Creek (Units 98, 99, 100, 282) have the potential to directly disturb willow flycatchers during the breeding season (May-Sept.) when proposed treatments are conducted. Treatments within these units are all hand treatments, and therefore, disturbance to willow flycatcher would be relatively minor, except for 45 acres of mastication proposed within Unit 99. Direct disturbance to willow flycatcher is likely to be short-term and would not all happen at the same time, since treatment units would be harvested at different times. Willow flycatcher habitat would not be altered or affected from proposed activities under Alternatives 1 and 3, since no treatments are proposed within willow flycatcher habitats.

Alternative 2, No Action, would not directly, indirectly, or cumulatively affect the willow flycatcher, since no activities are proposed.

Cumulative Effects

Effects of past, present, and reasonably foreseeable activities to willow flycatcher include changes to hydrologic condition of meadows and riparian willow habitat from fire suppression and historic grazing. Although, long-term declines in willow flycatcher populations have been documented across the Sierra Nevada Bioregion, historical declines to the population have been attributed to loss of habitat and changes to habitat condition. Fire suppression in the last 100 years could potentially have altered the hydrologic condition of willow flycatcher meadow and willow habitats, where increased conifer competition for water resources lead to the drying of meadows. The Sagehen Creek area has not been grazed since the mid-1990s, but portions of the meadows along Sagehen Creek appear to have experienced some drying out which may be attributed to the increase in conifer encroachment (primarily lodgepole pine) into the meadows. The Sagehen Allotment was closed in 2008, but had not been consistently grazed since the early 1990's. Past sheep grazing along Sagehen Creek likely had little affect from sheep grazing, particularly since sheep grazing was primarily located within the uplands and did not concentrate in the riparian areas. In general, the habitat within the Sagehen Creek area is not high quality compared to sites that have a history of long-term occupancy by willow flycatchers, such as at Independence Lake and Carpenter Valley, which are characterized by large, wet meadow systems with a significant willow component. These two willow flycatcher sites are located outside of the Sagehen Basin. None of the proposed actions for the Sagehen Project under Alternatives 1 and 3 would add measureable effects to existing cumulative effects to the willow flycatcher, since the disturbance effects from proposed treatments would be short-term and minimal in scope and intensity. Thinning forests adjacent to meadow and willow habitats as proposed for Alternatives 1 and 3 could potentially benefit willow flycatcher in the long-term by reducing the competition for water resources from conifers encroaching onto meadow areas, and may benefit from the reduced risk of habitat loss to wildfires.

The Independence Lake site is outside of the existing Independence Allotment and is not being grazed. The Carpenter Valley site is within the Euer Allotment, which is predominantly comprised of private land. Currently, the Euer Allotment is vacant and has not been grazed by livestock since the early 2000's. It is not likely that current willow flycatcher habitat conditions is still experiencing affects from past grazing practices, or have likely recovered, at least for the Independence and Sagehen Creek sites. Since, the Carpenter Valley site is on private land, the habitat condition or grazing effects are unknown. Present and reasonably foreseeable future projects listed in Table 10 would not likely add to existing cumulative effects to willow flycatchers at Sagehen Creek, Independence Lake, or at Carpenter Valley, since willow flycatcher habitat would not be affected by proposed vegetation management activities, including the Independence Lake THP and others.

C. Willow Flycatcher: Conclusion and Determination

It is my determination that implementation of Alternatives 1 and 3 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the willow flycatcher within the planning area of Tahoe National Forest. In the absence of a range wide viability assessment, this viability determination is based on local knowledge of the willow flycatcher as discussed previously in this evaluation, and professional judgment.

GREATER SANDHILL CRANE

Status: USFS R5 Sensitive

A. Greater Sandhill Crane: Existing Environment

The greater sandhill crane is a California State Threatened species and is listed as Sensitive on the Region 5 Forester's Sensitive Species List (USDA Forest Service 1998). The Tahoe National Forest LRMP, as amended, does not provide specific management guidelines for this species. However, standards and guidelines designed to meet Riparian Conservation Objectives apply to the crane and its habitat (listed under the California red-legged frog).

Greater sandhill cranes of the west coast are not hunted, and are protected by the federal Migratory Bird Treaty Act of 1918 (USDA 1994). The California Central Valley population of sandhill cranes is the most western of five distinct populations. A total of 276 cranes were recorded within the state during a breeding pair survey in 1988 (California Department of Fish and Game 1997). In California, greater sandhill cranes winter primarily throughout the Sacramento, San Joaquin, and Imperial Valleys (Grinnell and Miller 1944). Current known breeding populations are located within Lassen, Modoc, Plumas, Shasta, Sierra, and Siskiyou Counties (James 1977, Littlefield 1982, California Department of Fish and Game 1994). In Tahoe National Forest, a breeding population of approximately 11 pair occur within Carman Valley and Kyburz Flats on the Sierraville Ranger District (Youngblood 1998, personal communication).

California pairs of sandhill cranes generally nest in wet meadow, shallow lacustrine, and fresh emergent wetland habitat, with nests constructed of large mounds of water plants over shallow water (Zeiner et al. 1990, California Department of Fish and Game 1994). Studies in California during 1988 showed water depths averaging 2.3 inches (California Department of Fish and Game 1994). Open meadow habitats are also used (Littlefield 1989). On dry sites, nests are scooped-out depressions lined with grasses (Zeiner et al. 1990). Nesting territory size depends on the quality of available habitat. Little is known about territory size for breeding adults in California.

Cranes do not breed until their fourth year, but then usually mate for life (Johnsgard 1975). Nesting activities begin with courtship in April. Peak breeding occurs in May through July, with nesting usually completed by late August. The average clutch size is two, ranging from one to three. Incubation takes approximately 30 days. Shortly after the second egg hatches, adults lead the young from the nest site and begin feeding them. Each adult generally feeds one chick. Chicks are aggressive toward each other, and, shortly after hatching one becomes dominant. Often this dominance leads one chick to be pushed away from the adults. This may cause the chick to starve or be consumed by a predator (Zeiner et al. 1990, California Department of Fish and Game 1994). Young fledge at about 70 days, but remain with their parents for up to one year (Harrison 1978).

Within nesting territories, water and foraging areas are the primary habitat elements necessary for reproductive success. Young cranes (colts) depend mostly on invertebrates during their first five or six weeks and sometimes starve to death when invertebrates decrease with water levels (Pacific Flyway Council 1997). In dry years colts are moved upland, where they feed primarily on grasshoppers and other insects (California Department of Fish and Game 1994). Adults feed on grasses, forbes, cereal crops, roots, tubers. Animal matter such as insects, mice, crayfish and frogs, is taken opportunistically, but should not be considered a major component of their diet.

Recruitment of young is suppressed by predation at most breeding areas within their range (California Department of Fish and Game 1994). Predation from coyotes, common raven and raccoons are a major factor in low nesting success, especially in years of low precipitation (Littlefield 1989, California Department of Fish and Game 1994, Pacific Flyway Council 1997). Preliminary studies indicate that up to 45% of egg losses and up to 76% of young crane mortality may be attributed to predation (Ivey 1995). Surveys conducted by R. Schlorff on greater sandhill cranes in California between 1979 and 1986 averaged a 5.6% recruitment rate, although a recruitment rate of 12% is necessary for population stability (Miller et al. 1972).

Spring and summer livestock grazing may cause a loss of nests and young due to nest desertion and trampling of young (Littlefield 1989). This can be extremely detrimental to breeding cranes, especially if water is limited (California Department of Fish and Game 1994). Lowering of ground water tables often results in stream down cutting with subsequent drying and degradation of wetland habitats (California Department of Fish and Game 1994).

Sandhill cranes are readily identified by their very, large size (~4 ft. tall) and distinguished field characteristics of gray body, long neck, long legs, red forehead, and white cheeks. Within the Tahoe NF, greater sandhill cranes are known to breed at Kyburz and Perazzo Meadows on the Sierraville Ranger District and north of Stampede Reservoir at Sardine Valley on private land. Sandhill cranes are not known to breed within the Sagehen Basin, and therefore, Alternatives 1 and 3 will not directly, indirectly, or cumulatively affect the Greater sandhill crane or its habitat, and no further analysis is needed.

It is my determination that implementation of Alternatives 1 and 3 will not affect the greater sandhill crane. Known sandill crane breeding habitat occurs outside of the Sagehen Basin.

FOREST CARNIVORES – GENERAL DISCUSSION

The fisher, marten, Sierra Nevada red fox, and wolverine are carnivores found in the Sierra Nevada of California and are collectively known as "forest carnivores." All are listed as Sensitive on the Region 5 Forester's Sensitive Species List. At the present time, forest carnivore survey protocols can only determine presence. If no individuals are detected, the absence of individuals cannot be concluded with any level of confidence. Until recently, most sighting information on forest carnivores in the Sierra Nevada has been incidental and usually unverified.

Tahoe National Forest completed a forest wide habitat management plan for these species in 1992, the <u>Recommendations for Managing Late Seral Stage Forest and Riparian Habitats on the Tahoe National Forest</u> (Chapel et al. 1992). This was the basis for inclusion of an old forest/riparian corridor system for each project analyzed prior to October 1, 1998. On May 1, 1998, the Regional Forester requested that each forest complete a mesocarnivore network. Tahoe National Forest completed that network on September 29, 1998, incorporating new information that focused the network on the needs of marten and fisher instead of the more wide-ranging old-forest/riparian concept. Maps and information on how the network was developed are on file at the Supervisor's Office. This information, in conjunction with the land allocations identified in the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001), is used during site-specific project analysis to identify potential movement corridors between habitat patches and when developing desired conditions.

PACIFIC FISHER

Status: USFS R5 Sensitive, USFWS Candidate

A. Pacific Fisher: Existing Environment

The Pacific Fisher is designated as a Regional Foresters' Sensitive Species in Region 5, and by the USFWS as a Candidate for listing as threatened or endangered. The USFWS received petitions to list western populations of the fisher under the Endangered Species Act in 1990 and 1994. These petitions were considered as having insufficient persuasive scientific information for the USFWS to propose listing. On December 2000, the Pacific fisher was again petitioned for listing as a distinct population segment as endangered, and to designate critical habitat based on new information detailing the fisher's fragmented distribution in this region. On June 27, 2003, the USFWS announced a 90-day finding that the petition to list the west coast population (Klamath Mountains, North Coast Ranges, and southern Sierra Nevada) of the fisher may be warranted (USDI Fish and Wildlife Service 2003; 68 FR 41169). On April 8, 2004, the USFWS announced a 12-month finding on that petition, that the petitioned action was warranted but precluded by higher priority actions. The West Coast distinct population segment of the fisher was added to the USFWS Candidate species list as of that date (USDI Fish and Wildlife Service 2004; 69 FR 18770).

Historically, fishers were distributed across forested regions of California in the Sierra Nevada, Klamath Mountains and North Coast Ranges. Fishers appear to have been unevenly distributed but found along the length of the Sierra Nevada historically, and now have a distributional gap from eastern Shasta County in the southern Cascades to Mariposa County in the central Sierra Nevada (Zielinski et al. 2005). This reported gap includes Tahoe National Forest. The fisher populations in California differ genetically from each other and from all other fisher populations in North America (Drew et al. 2003). The extirpation of fishers throughout much of their historic range in the Pacific states is attributed to over trapping and habitat alteration (Zielinski et al. 1995, Lewis and Stinson 1998, Aubry and Lewis 2003).

In California, Pacific fisher most often occur at elevations between 82 to 3,280 feet (Golightly et al. 1997) in the North Coast region. They occur sympatrically with marten in the southern Sierra Nevada between 5,000 to 8,500 feet elevation in mixed conifer forests (Zielinski et al. 1996). Krohn et al. (1997) suggest that fisher are limited by deep snow, and consequently occupy lower elevations, while marten occupy higher elevations. This may be due to lower mobility of the fisher in soft snow, as the foot-loading (ratio of body mass to total foot area) of the fisher is >2 times higher than the marten (Krohn et al. 2005). The historical and contemporary distributions of the fisher in California are clearly associated with areas of low snowfall across a wide range of forest types, and forest types known to be used by fishers in California appear to be used less when located in deep snow areas (Krohn et al. 1997).

Vegetation used by fisher is structurally complex. They are typically found in late-successional coniferous forests (Freel 1991, Buskirk and Powell 1994) that generally correspond with CWHR types 4M, 4D, 5M, 5D, 6, in stands of at least 80 acres (Freel 1991), with the following attributes:

- Overhead cover (based on Freel 1991, Buskirk and Powell 1994)
- Presence of large-diameter snags (Allen 1987, Chapel et al. 1992, Freel 1991, Buskirk and Powell 1994) distributed across the landscape
- Large-diameter (at least 15-inch dbh by 15 feet long) downed logs (Chapel et al. 1992, Freel 1991, Buskirk and Powell 1994) distributed across the landscape
- Large-diameter (greater than 24-inch dbh) live conifer and oak trees with decadence such as broken tops or cavities (chapel et al. 1992, Freel 199)
- Complex structure near the ground (e.g., downed logs, large downed branches, root masses, live branches) (Buskirk and Powell 1994)
- Multi-layered vegetation (vertical within-stand diversity) (Chapel et al. 1992, Freel 1991)

The fisher is considered to be one of the most habitat-specific mammals in North America (Buskirk and Powell 1994), and changes in the quality, quantity, and distribution of available habitat can affect their distribution in California. Buskirk and Powell (1994) suggested that fisher distribution and abundance may be a function of the location of suitable habitat in relation to forest openings. Fishers will likely use patches of preferred habitat that is interconnected by other forest types, but they will not likely use patches of habitat that are separated by large open areas. In Trinity County, California, Buck et al. (1983) noted that fisher generally avoided areas without overhead cover and preferred old growth forests.

Preferred habitat is often in close proximity to dense riparian corridors and saddles between major drainages or other landscape linkage patterns used as adult and juvenile dispersal corridors. It includes an interspersion of small (<2 acre) openings with good ground cover used for foraging. Riparian areas are very important to fisher. Abundant evidence exists for selective movement patterns along drainages (Buck et al. 1983).

Home range sizes for the fisher are variable across their range, and in any particular area male fishers have larger average home range sizes than females (as reviewed in Powell and Zielinski 1994, Zielinski et al. 2004). In California, Zielinski et al. (2004) found that female fisher home range sizes were almost three times smaller in the southern Sierra Nevada compared to the north coastal area, and suggested this may potentially due to higher habitat quality in the southern Sierra Nevada, where productive habitats rich in black oak are common constituents of forests occupied by fishers, providing cavities used as rest sites and acorns used as food by prey species. Zielinski et al. (2004) report estimates of average home range size in coastal northern California of approximately 3,700 acres for females and 14,300 for males, and in the southern Sierra Nevada 1,300 acres for females and 7,400 acres for males.

Important vegetation types for the fisher include montane hardwood conifer, mixed conifer, Douglas fir, redwood, montane riparian, Jeffrey pine, ponderosa pine, lodgepole pine, subalpine conifer, aspen, eastside pine and red fir. Predominant use is in Douglas fir and mixed conifer forests along the north coast of California and mixed conifer forests in the southern Sierra Nevada. In the north coast area, Zielinski et al. (2004) found that the mid-seral Douglas-fir type composed the largest mean proportion area of the home ranges (24.5%), followed by mid-seral true fir (18.3%), and late seral Douglas-fir (14%). In the southern Sierra Nevada, the Sierran mixed conifer type occupied the largest mean proportion area of the home ranges (40.4%), followed by the ponderosa pine type (32.9%), and the montane hardwood type (12.3%); tree size class 4 (11-24” dbh) stands and canopy closure class D (>60%) occupied the highest proportion area at 60.7% and 66.3%, respectively (Zielinski et al. 2004).

The size of habitat patches and their distribution is important to wide-ranging forest carnivores such as the fisher. There is concern that additional logging in fisher habitat may not maintain enough large tracts of mature forests or provide adequate movement corridors to sustain populations. There have been no confirmed sightings in the northern Sierra Nevada since the 1940’s. Fishers in the southern Sierra Nevada appear to be isolated from those in northern California by a distance that exceeds their maximum observed dispersal distance by more than three times (Lamberson et al. 2000).

Numerous and heavily traveled roads are not desirable in order to avoid habitat disruption and/or animal mortality. Roads may decrease prey and food availability for fisher (Allen 1987) due to decreases in prey populations resulting from road kills and/or behavioral barriers to movement. Occasional one and two lane forest roads with moderate levels of traffic should not limit fisher movements.

Fishers are known to be opportunistic predators with a diverse diet including birds, porcupines, snowshoe hare, squirrels, mice, shrews, voles, reptiles, insects, deer carrion, vegetation, and fruit. Microtine rodents are important prey species for both fisher and marten in many areas of North America. The abundance of a favored prey species, the southern red-backed vole (*Clethrionomys gapperi*) has been positively correlated with abundance of woody debris on the forest floor (Allen 1987). Maser et al. (1978) attributed the elimination of red-backed voles from clear-cuts to xerification (drying out) of the habitat, loss of downed woody material and elimination of the vole's primary food, which are mycorrhizal fungi. Elimination of woody debris and loss of understory vegetation can decrease populations of small prey species of mammals in forested habitats and, therefore, similarly affect populations of marten and fisher.

Summary of primary risk factors:

- Reduction of overhead cover, large-diameter trees, or coarse woody debris from vegetation management (including even-aged management, group selection, thinning, and salvage) and prescribed burning
- Mortality or behavior modification from recreational activities including OHV and OSV use
- Mortality from vehicles
- Behavior modification associated with the presence of vehicles and humans
- Habitat fragmentation from roads and/or vegetation alteration

The Pacific fisher has not been verified on the Tahoe NF despite numerous surveys across the Tahoe NF over several years. The Pacific fisher is known to occur below elevations of 5,000 feet and the Tahoe NF is within the known distributional gap for the species (Zielinski, et al. 2005). Therefore, the Sagehen Project, which lies above 6,000 feet, will not affect the Pacific fisher.

It is my determination that implementation of Alternatives 1 and 3 will not affect the Pacific fisher. Project design standards and mitigation measures proposed for the Pacific marten, are likely to provide for fisher habitat, in the event that fisher are relocated or expand to the Sagehen Basin.

PACIFIC MARTEN

Status: USFS R5 Sensitive

A. Pacific Marten: Existing Environment

The Pacific marten (*Martes caurina*) is listed on the USFS R5 Sensitive Species List.

The marten historically occurred in forests throughout North America, experienced reductions in portions of its range due to intensive trapping and reduction in habitat quality, and has since been reestablished in portions of the historic range with natural expansions and with the aid of translocations (summarized in Kucera et al. 1995). Recent genetic and morphological evidence has warranted splitting the American marten into two species: the American marten east of the Rocky Mountain crest (*Martes caurina*) and the Pacific marten (*M. caurina*) west of the crest (Dawson and Cook 2012). Two subspecies of the Pacific marten are recognized in California: the Sierra marten (*M. c. sierrae*) in the Sierra Nevada, Cascades, and Klamath/Trinity mountains, and the Humboldt marten (*M. c. humboldtensis*) in the redwood zone along the north coast. In California, marten were trapped for fur until prohibited in 1946 in the extreme northwestern portion of the state, and throughout the State in 1953 (summarized in Kucera et al. 1995). The Humboldt marten was thought to be possibly extinct from the coastal range at one time (refer to Kucera et al. 1995, and Zielinski and Golightly 1996 as cited in Zielinski et al. 2001), but marten are now known to exist in a small area in California's north coast range (Zielinski et al. 2001, Slauson 2003, Slauson et al. 2007). Besides the Humboldt marten and two other subspecies in eastern Canada, most of the other known subspecies appear to be well distributed within their geographic ranges, including the Sierra Nevada population (Zielinski et al. 2001). Marten are known to exist in suitable habitat on all the National Forests in the Sierra Nevada Province; however, Zielinski et al. (2005), based on recent survey data, report a gap in the current distribution centered on Plumas County which was not historically present.

In the Sierra Nevada marten generally occur at elevations of ~4,500 feet to 10,500 feet, averaging 6,600 feet. Kucera et al. (1995) describe the distribution of the marten in California from eastern Siskiyou and northwestern Shasta Counties through the western slope of the Sierra Nevada to northern Kern County, and on the eastern slope of the Sierra Nevada as far south as central-western Inyo County. In the southern Cascades and northern Sierra Nevada, Kirk (2007) noted that 85% of contemporary marten detections in his analysis occurred above 6,000 feet elevation (despite a reduced survey effort at these higher elevations), 15% of detections were between 3,000 and 6,000 feet, and no detections of marten occurred below 3,000 feet elevation. They most often occur at somewhat higher elevations than the fisher (Freel 1991, Zielinski et al. 2005, Zielinski 2013). In contrast to the fisher, the marten distribution in California corresponds closely to the regions of the heaviest snowfall in the southern Cascades and the Sierra Nevada (Krohn et al. 1997). This may be due to lower mobility of the fisher in soft snow, as the foot-loading (ratio of body mass to total foot area) of the fisher is >2 times higher than the marten (Krohn et al. 2005). Where their ranges overlap, there may be negative competitive interactions between the fisher and marten (Krohn et al. 1995, Krohn et al. 1997). Fuller and Harrison (2005) note that fishers are a principal arboreal predator of martens in Maine.

Preferred forest types in the Sierra Nevada include mature mesic forests of red fir, red fir/white fir mix, lodgepole pine, subalpine conifer, and Sierran mixed conifer (Freel 1991). CWHR types 4M, 4D, 5M, 5D, and 6 are moderate to highly important for the marten (USDA Forest Service 2001). Analysis of effects to marten weighs heavily on the preferred habitat types, but consideration is given for the utilization of other marginal habitat types. Forest stands dominated by Jeffrey pine do not appear to support marten in Tahoe National Forest (Martin 1987), as evidenced by the lack of marten detections in pure eastside pine (some of which were adjacent to mixed conifer stands which did contain marten detections) during systematic surveys conducted on the eastside of Tahoe National Forest (data on file at Sierraville Ranger District).

Preferred habitat is generally characterized by dense canopy, multi-storied, multi-species late seral coniferous forests with a high number of large (> 24 inch dbh) snags and downed logs (Freel 1991). Late- and old-structure forests (with larger diameter trees and snags, denser canopy and more canopy layers, and plentiful course woody material) are thought to provide ample rest and den sites, protection from avian and mammalian predators, and foraging sites (Bull et al. 2005). Data from some studies shows that use of habitat by marten does not necessarily rely on high levels of canopy cover, but likely involves a complex interaction of habitat variables, at both small and large scales, which provide for their life history requirements and minimizes the risk of predation on them (refer to Soutiere 1979, Drew 1995, Chapin et al. 1997, and Slauson 2003). Koehler and Hornocker (1977) suggested that while open meadows and burns may be avoided by marten in winter when they are under a heavy snowpack, these areas may be used in the summer, or in low snow years, if they provide adequate cover and food.

Marten have been found to be generally associated with mesic conifer-dominated forest conditions (eg. Spencer et al. 1983, Martin 1987, Buskirk et al. 1989, Wilbert et al. 2000, Mowat 2006, Baldwin and Bender 2008). Studies in the Sierra Nevada indicate martens have a strong preference for forest-meadow edges, and riparian forest corridors used as travel ways appear to be important for foraging (Spencer et al. 1983, Martin 1987). Spencer et al. (1983) found that in the lower Sagehen Creek basin on the eastside of Tahoe National Forest below approximately 6,700 feet elevation, marten strongly preferred riparian lodgepole pine habitat and selected against brush, mixed conifer, and Jeffrey pine habitats; riparian areas were used more for activity than resting, and mixed conifers were used more for resting than activity. In the upper Sagehen basin above approximately 6,700 feet elevation, marten were found to strongly prefer red fir habitat associations for both resting and activity (Spencer et al. 1983). Spencer et al. (1983) found that marten preferred forest stands with 40-60% canopy cover at both resting and foraging sites and avoided stands with less than 30% canopy cover. In Rocky Mountain National Park in Colorado, Buskirk et al. (1989) found that marten resting sites in winter were more often in spruce-fir forest compared to lodgepole pine, and were most frequently associated with course woody debris (which occurred more in the spruce-fir forest compared to lodgepole forest) especially in periods of colder temperatures and in closer proximity to riparian areas. Wilbert et al. (2000) found this same pattern, where subnivean resting tended to occur in spruce-fir dominated forest, likely because this stand type has more physical structure near the ground in the form of course woody debris and lower branches of live trees. In Rocky Mountain National Park in Colorado, Baldwin and Bender (2008) found that marten in summer were associated with mesic versus xeric forest; riparian mixed-conifer stands were strongly related to occurrence of marten across all scales that they analyzed and with different models. In southeastern British Columbia, Mowat (2006) found at the broad scale that martens preferred more mesic conditions and preferred coniferous stands over deciduous-dominated stands, and at the finer scale prefer older stands and higher canopy cover.

Coarse woody debris is an important component of marten habitat, especially in winter, by providing structure that intercepts snowfall and creates subnivean tunnels, interstitial spaces, and access holes (Andruskiw et al. 2008). Zielinski et al. (1983) suggested that marten activity varied to allow them to take advantage of subnivean dens utilized by their prey. Sherburne and Bissonette (1993) found marten more likely to utilize subnivean access points in areas that contained more abundant prey. They also found that when coarse woody debris covered a greater percent of the ground, marten use also increased (Sherburne and Bissonette 1993). Older growth forests with accumulated coarse woody debris provide the forest floor structure necessary to enable marten to forage effectively during the winter (Sherburne and Bissonette 1993). In Ontario, Andruskiw et al. (2008) found that despite having lower levels of course woody debris, the availability of subnivean access points was not less in regenerating forest compared to uncut forest due to access points created by low-reaching branches of young conifer trees; however, only the subnivean access points created by course woody debris contained small mammals and were used by marten.

In northeastern Oregon, Bull et al. (2005) found that martens used all available forest types sampled (Early 2%, Mid-early 16%, Late 27%, Old 46%, Remnant 9%), but show a strong preference for older structured, unlogged stands in subalpine fir and spruce forests with canopy closures >50%, a high density of snags and logs, and in close proximity to water. Bull et al. (2005) also found that marten used all levels of canopy closure (0 to 24% CC = 3%, 25 to 49% CC = 10%, 50 to 74% CC = 61%, >75% CC = 26%). Cablk (2003) used GPS tracking of marten, and the behavior showed an increased use of open areas (ski runs) compared to use patterns determined by radio tracking. In a study of the Humboldt marten near the Pacific coast, Slauson (2003) detected martens at survey stations in serpentine habitats (soils with harsh growing conditions) more often when they had lower canopy closure (mean canopy closure of 31% in detection locations versus mean canopy closure of 61% in non-detection locations), but noted that detection locations had a high average shrub cover (83%) and relatively high average boulder-sized surface rock cover (27%). In more productive non-serpentine sites, Slauson (2003) found that increased shrub cover and relative percent conifer cover appeared to be important habitat attributes in areas with detections versus non-detections. In Colorado, Baldwin and Bender (2008) found that while martens routinely avoided open herbaceous wetlands and herbaceous uplands, one of their models indicated they appeared to use talus and rock fields, possibly because these areas provided cover and foraging opportunities.

In Maine, Chapin et al. (1997) indicate that marten may neither prefer nor require conifer-dominated forests or forests with a closed overstory canopy throughout all of their geographic range. In their study, marten selected stands with an abundance of snags, high volume of fallen dead trees and root mounds, and regenerating understory of deciduous and coniferous vegetation, despite canopy closures of mature trees less than 50%, and typically less than 30%. Vertical and horizontal structure may be more important habitat attributes than age or species composition of the forest overstory (Buskirk and Ruggiero 1994, Chapin et al. 1997). Chapin et al. (1997) recommend that conservation practices focus on structural attributes that functionally influence the quality of forested habitats for marten, rather than merely age, species composition, and canopy closure of overstory trees, and that these structural requirements could be maintained in a variety of managed and unmanaged stands. Also in Maine, Fuller and Harrison (2005) evaluated seasonal home range characteristics and habitat selection in partially harvested stands with canopy cover and basal area of live trees reduced below the recommended levels. Fuller and Harrison (2005) found that marten home ranges included a greater proportion of partially harvested stands during the leaf-on season (maximum = 73%) than during the leaf-off season (maximum = 34%); higher use of partially harvested stands during the leaf-on season coincided with greater canopy closure, higher use of small mammals, and greater relative densities of small mammals (Fuller and Harrison 2005). Fuller and Harrison (2005) noted that “partially harvested stands probably retained sufficient mature forest characteristics by way of horizontal and vertical structure and canopy closure to receive substantial use by martens during the leaf-on season”. During the leaf-off season, martens exhibited greater selection for second-growth stands (Fuller and Harrison 2005).

Marten home ranges are large by mammalian standards, particularly for their size (Buskirk and Ruggiero 1994, Buskirk and Zielinski 1997). Martens exhibit a high level of variation in home range size throughout their range, and generally exhibit a low level of same-sex overlap (Bull and Heater 2001). From numerous studies across the range of the marten, Powell (1994) calculated the mean home range size for males of 2,000 acres and for females 570 acres (as cited in Powell et al. 2003). Marten home range sizes in the Sierra Nevada have been reported to vary from approximately 420 to 1,800 acres for males, and 170 to 1,400 acres for females (summarized data from Simon 1980, Spencer 1981, Martin 1987, and Zielinski et al. 1997 as reported in Buskirk and Zielinski 1997). Variation in home range size may be a function of prey abundance or habitat quality (Ruggiero and Buskirk 1994). In northeastern Oregon, Bull and Heater (2001) found that home range size was not correlated to the amount of unharvested forest in their study. In Maine, Chapin et al.

(1998) found that regenerating forest (stands harvested in approximately the past 15 to 20 years) composed a median of 22% (range 9-40%) of male home ranges and 20% (range 7-31%) of female home ranges; the largest residual forest patch (contiguous areas composing adjacent stands of mid- to late-successional forest) in the home range composed a median of 75% (range 30-90%) of male home ranges and 80% (range 51%-93%) of female home ranges. In Maine, Fuller and Harrison (2005) found that home ranges of males and females during the leaf-off season were up to twice as large for martens whose home ranges included partial harvesting than those that did not, suggesting lower habitat quality in those areas and possibly related to low availability of snowshoe hares in the partially harvested stands.

In Wisconsin in winter, Dumyahn et al. (2007) calculated a mean core area (defined as the 50% fixed kernel home range) size of 168 acres for males and 94 acres for females. The core areas had a higher average proportion of highly used cover-types than either the wider home range or the study area, but because the variance around this average was large, the cover-type composition of core areas was statistically indistinguishable from both the home range and the overall study area (Dumyahn et al. 2007). These core areas contained high densities of telemetry locations, which may correspond to microhabitat features which the marten were selecting for at finer spatial scales (Dumyahn et al. 2007).

At the larger scale, several studies indicate that there is a threshold of percentage suitable habitat across a landscape for marten occupancy. In three separate studies which occurred in Utah, Maine, and Quebec, the researchers found that landscapes with openings which cover more than 25 percent of the area limited habitat suitability for marten (Potvin et al. 2000, Hargis et al. 1999, Chapin et al. 1998). Dumyahn et al. (2007) found similar results in Wisconsin, where marten home ranges contained 72% highly used habitat and 18% avoided habitat. Fuller (2006) found that declines in marten occupancy occurred much sooner in Maine (70-80% suitable habitat) than in Newfoundland (30-40% suitable habitat). In west-central Alberta, Webb and Boyce (2009), through analysis of trapping records, found that probability of trapping success was greatest when the proportion of closed-conifer forest was approximately 45% and declined with >55% closed-conifer forest; they found no traplines with consistent marten harvests that had <20% closed-conifer forest cover. In Utah, Hargis et al. (1999) found that marten captures declined as openings in the landscape increased. They also noted declines in marten captures as edge increased and where open areas were more closely spaced, and no captures occurred where openings occupied greater than 35% of the landscape or where the average distance between openings was less than 100 meters. Hargis et al. (1999) recommend that land managers identify forested areas approximately 2-3 square miles in size that contain structural attributes associated with optimum marten habitat (large diameter conifers, canopy cover >30%, and abundant large diameter logs), and to maintain the landscape so that the percentage of non-forested acreage does not exceed 20% of the total (including clear-cuts, meadows, and natural openings). They further state that the forested areas need not be closed to timber harvests, but selective cutting methods should be considered over clear-cutting when possible. Where clear-cutting is proposed, cut blocks should be separated by forested buffers greater than 650 feet wide. Webb and Boyce (2009) found that proportion clear-cut was not a strong predictor of trapline success or marten harvests, and suggested this may have been due to trappers capitalizing on expected spikes in short-term marten harvests from areas recently cut; they noted that large-scale logging is relatively new in their study area, with only 4% of the area logged (Webb and Boyce 2009).

Drew (1995) suggested that some fine-scale selection factor not linked to foraging strategy, such as minimizing the risk of predation by avoidance of open areas, appears to influence habitat selection, and recommended maintenance of landscape connectivity to prevent isolation of forest patches. Kirk (2007) found the best association for marten occurrence at the largest scale he modeled (30.9 mi^2), with amount of habitat, number of habitat patches, and land ownership category emerging as important variables, suggesting selection based upon broad scale landscape conditions. The size of openings that martens will cross in the Sierra Nevada or Cascades is currently under study (Zielinski 2013). However, in the Rocky Mountains, the average width of clear cuts (openings) crossed by martens was 460 ft; this distance is significantly less than the average width of clear cut openings that martens encountered but did not cross (average = 1,050 ft) (Heinemeyer 2002). Moreover, martens were more likely to cross larger openings (max distance = 600 ft.) that had some structures in them (i.e., isolated trees, snags, logs) than smaller openings (average distance = 160 ft) that had no structures (Heinemeyer 2002). Cushman et al. (2011) reported that snow-tracked martens in Wyoming strongly avoided openings and did not venture more than 55 feet from a forest edge.

In the Sagehen Creek basin in Tahoe National Forest, Moriarty et al. (2011) found that marten detections decreased from an average detection rate of 65% in the early 1980s (Spencer 1981, Zielinski 1981, Martin 1987) to 4% in her study conducted from 2007-2008, based on similar but not identical methodology. Analysis of prior research in this area showed that the distribution of marten detections changed spatially from a semi-uniform distribution in the upper and lower basin in 1980s to detections that were clustered in the southwest corner of the upper basin by the early 1990s (Moriarty et al. 2011). The reasons for the apparent decrease in marten abundance were not clear, but may have included reduction of habitat quality, increase in habitat fragmentation, loss of important microhabitat features such as snags and down woody material, or other factors (Moriarty et al. 2011). From 1984-1990 more than 30% of the forested habitat in the Sagehen basin was impacted by various logging treatments (Moriarty et al. 2011). Moriarty et al. (2011) suggested that rather than amount of habitat (which did not change significantly), it is likely that the size of patch core areas, distance between patches, spatial configuration of patches, and microhabitat features within patches may be more important for marten persistence.

In Yosemite National Park, Hargis and McCullough (1984) found that marten in winter will cross meadows with no cover ≤50 meters wide, and using scattered trees for cover across meadows >50 meters wide to a maximum of 135 meters. Their methods involved tracking marten over snow and noting travel points and pause points, defined as points where marten engaged in some activity such as entering the subnivean zone, resting, or feeding). Marten traveled in all major habitat types, without any detectable habitat preferences, but did not pause in openings (only in forests, ecotones, and on frozen streams); locations where they paused were associated with closer distance to the nearest tree, percentage of overhead cover, and height (< 3 meters) of overhead cover (Hargis and McCullough 1984). In their study, although marten showed a preference for areas with low height of overhead cover, they were not selective for dense forest stands (neither basal area nor number of trees were important habitat variables); they traveled in a zigzag type pattern from one tree to next, often altering course to investigate animal tracks; two-thirds of travel points were within 2 meters of a tree and there was no preference for a particular tree size class (Hargis and McCullough 1984). In Maine, Soutiere (1979) observed that marten would occasionally cross through 200 meter wide clear-cuts to get to forested islands, generally with a more direct travel route than when in forested areas, but they would investigate windfalls and slash that protruded through the snow cover. Koehler and Hornocker (1977) observed that marten passed through but did not hunt in openings less than 100 meters wide. Larger open areas which lack ground cover may pose a predation risk for the marten (Drew 1995). Drew (1995) found that habitat dominated by defoliated stems (due to tree mortality from bug infestations in his study) may provide sufficient cover.

Marten rest sites in winter are most often in subnivean sites most often associated with course woody debris especially during periods of colder temperatures and recent precipitation but can also be found in association with rocks (Buskirk et al. 1989, Bull and Heater 2000, Wilbert et al. 2000). Rest sites next to course woody debris in the subnivean space offer thermal insulation in colder temperatures (Buskirk et al. 1989). In northeastern Oregon, Bull and Heater (2000) found that diurnal behavior was significantly different by month and snow depth. Most of the martens located were in rest sites during winter, and traveling during summer (Bull and Heater 2000). During winter, marten spent most of their time in subnivean rest sites, which were usually created by either an accumulation of logs, a hollow log, or a single large log; at least 75% of the subnivean rest sites had evidence of red squirrel middens (Bull and Heater 2000). In California, the red squirrel (*Tamiasciurus hudsonicusis*) is replaced by the Douglas squirrel (*Tamiasciurus douglasii*), which also feeds intensively at one location creating a squirrel midden (a build-up of discarded vegetative material). Spencer et al. (1983) found that marten preferred activity and resting sites having Douglas squirrel feeding sign. In summer, Bull and Heater (2000) found that platforms in trees were the dominant rest sites. Trees with cavities are used as rest sites all year, especially during periods of colder temperatures with higher precipitation; in their study location December and April (Bull and Heater 2000).

Marten natal and maternal den structures may occur in rock crevices, snags, squirrel middens, logs, artificial log structures, slash piles, squirrel nests, live trees, underground, and in at least one case a boulder field (Ruggiero et al. 1998, Bull and Heater 2000). In Wyoming, Ruggiero et al. (1998) found that red squirrel middens were strongly favored for parturition sites (56%) and were often associated with large-diameter logs and other course woody debris. Buskirk et al. (1989) found that in winter adult marten used subnivean resting sites located next to course woody debris in spruce-fir especially during colder temperatures and re-used the same resting sites more frequently, whereas juvenile marten rested more often in lodgepole pine stands without as much course woody debris and used the same resting sites less frequently. They suggested different use of resting sites by adults and juveniles as either due to exclusion of juveniles from preferred habitats due to territorial influences, or to experiential learning by juveniles over time as to what constitutes a good resting site (Buskirk et al. 1989). During periods of warmer temperatures, marten rested for shorter periods of time and showed increased use of rock fields (below snow surface) and above-ground locations such as snags for resting (Buskirk et al. 1989). Wilbert et al. (2000) found that use of subnivean versus supranivean resting sites increased with lower temperature and recent (previous 24 hours) snowfall. In their study in Wyoming, the mean diameter of trees and snags in which cavities were used for resting was 20" dbh, which was significantly larger than trees and snags used for resting on branches (mean dbh 13") (Wilbert et al. 2000).

Prey species abundance is a critical component of the habitat and there is some dietary overlap with the fisher, particularly in the southern Sierra Nevada where they occur sympatrically (Zielinski and Duncan 2004). Both species prey heavily upon squirrels, but marten diet has been found to be diverse, including a variety of mammals, birds, reptiles, fish, insects, seeds, and fruits (Koehler and Hornocker 1977, Soutiere 1979, Hargis and McCullough 1984, Zielinski and Duncan 2004). Marten prey items vary seasonally and appears to depend on availability. Simon (1980) found insects dominating the diet in summer and fall, while Douglas squirrels (*Tamiasciurus douglasii*) provided the bulk of winter and spring nourishment. At Sagehen Creek, CA, within the Truckee Ranger District, Zielinski (1983) found microtine rodents the most frequent year-round prey. Chickaree, snowshoe hare, northern flying squirrel, and deer mouse were taken almost exclusively during the winter; and squirrels and chipmunks formed the largest component of the diet from late spring through fall. Hargis and McCullough (1984) found that marten diet differed by year (winter in their study) possibly related to prey availability and/or depending on environmental factors; there was a pronounced difference in winter precipitation and the snowpack in different years in their study. In the southern Sierra Nevada, Zielinski and Duncan (2004) found that the marten and fisher diet is similar and highly diverse; the marten diet consisted of 34 distinguishable taxa of animals and plants, with squirrels the highest proportion at 22%. Moritz et al. (2008) investigated the effects of climate change over the past century in Yosemite National Park on small mammal distributions. They found variable elevational shifts amongst small mammal species (even for closely related species), but high-elevation species typically experienced range contractions from lower elevations (50% of high-elevation species) and low-elevation species typically expanded their range upward (50% of low-elevation species), a pattern expected with increased temperature (analysis of regional weather records indicate a 3.7° C (6.7° F) increase in average minimum monthly temperature over the past 100 years) (Moritz et al. 2008).

Numerous and heavily traveled roads are thought to be undesirable in order to avoid habitat disruption and/or animal mortality. Roads may decrease prey and food availability for marten as well as fisher (Allen 1987) due to prey population decreases resulting from road kills and/or behavioral barriers to movement. In Ontario, Robitaille and Aubry (2000) found that while martens were as likely to be detected near roads as they were away from roads, analysis of marten track density showed more activity away from roads, suggesting that marten movement differed when near roads. Other studies have shown that occasional one and two lane forest roads should not limit marten movements. In Maine, Chapin et al. (1997) found that 73% of all telemetry locations of marten were within ¼ mile of a road, despite this area only occupying 32% of the study area; it may be important to note that in their study, trapping effort to attach transmitters was focused primarily along roads. In southeastern British Columbia, Mowat (2006) found that density of roads did not emerge as an important variable for marten occupancy, noting that the relationship between marten presence and roads was positive but that this was most likely related to marten preference for wetter ecosystems or lower elevations where roads are often located. In his southern Cascades and northern Sierra Nevada study area, Kirk (2007) found that the amount of roads did not emerge as an important variable in his analysis of marten detections at varying scales. In a forest managed for timber harvest in Maine, Chapin et al. (1998) concluded that marten responded more strongly to forest fragmentation associated with clear-cut logging than to proximity to forest roads; the median density of roads in marten home ranges exceeded 1.3 mi/mi^2 in their study. In two study sites in California (Lake Tahoe Basin Management unit and Sierra National Forest), Zielinski et al. 2008 found that off-highway vehicle and over-the-snow vehicle use (at least up to 1 vehicle per 2-hour time period) had no effect to marten occurrence, circadian activity, or sex ratio. In west-central Alberta, Webb and Boyce (2009) found that no traplines with consistent marten harvests through time had >36% of the trapline developed; in their study roads and oil and gas wells were the primary form of development.

Project Specific Information:
Marten have been detected throughout the Sagehen Basin since the early 1980s by various researchers, including Sandy Martin, Terri-Simon Jackson, Wayne Spencer, and Bill Zielinski. Concern regarding marten declines within the Sagehen Basin led to a research study on marten distribution and habitat changes over a 30 year period (Moriarity et al. 2011). During 2007 and 2008, systematic and comprehensive marten surveys were completed across the majority of the Sagehen Basin within mature to late-successional forests were completed. A variety of methods were used, including remotely sensed cameras, track plates, and genetic analysis from hair or scat samples. Areas dominated by younger forests, including plantations were not sampled. Marten were detected during 2008 between the months of January and March. The majority of marten detections were located in the southwestern portion of the uppermost Basin in forests dominated by red fir, lodgepole pine or mixed conifer forests comprised of a combination of white fire, lodgepole pine, and red fir. These marten detections encompassed approximately one-third of the total Basin area in areas that have the greatest concentration of high quality marten habitat. Moriarty et al. (2011) found that marten population declines within the Basin coincided with the period of intensive timber harvest between 1983 and 1990.

Marten have also been detected by Forest Service biologists just north of the Basin on the Sierraville Ranger District in 2003 for the Phoenix Project planning and analysis.

Suitable Marten High Quality Denning and Foraging Habitat Description and Analysis Area

Suitable marten habitat for analyzing the direct, indirect, and cumulative effects project alternatives was generated by modeling habitat using the current Tahoe NF vegetation map and Geospatial Interface tools for ArcGIS. The existing vegetation maps are classified using the CWHR classification system. During the Sagehen Project collaborative process, a marten subcommittee was convened to refine marten habitat suitability definitions as follows:

Table 34. Definitions of High and Moderate Quality Marten Habitat within the Sagehen Basin (Moriarty 2009, modified)

Habitat	Forest Type	Size Class*	Canopy Closure**
High Quality			
	Lodgepole Pine (LPN)	4, 5	M, D
	Montane Riparian (MRI)	5, 6	M, D
	Red Fir (RFR)	4, 5	M, D
	Subalpine Conifer (SCN)	4, 5	M, D
	Sierran Mixed Conifer (SMC) – Fir dominated stands only	5, 6	M, D
	White Fir (WFR)	4, 5, 6	M, D
Moderate Quality			
	Eastside Pine (EPN) – with a lodgepole pine component only	4, 5, 6	P, M, D
	Eastside Pine (EPN)	5, 6	M, D
	Jeffrey Pine (JPN)	5, 6	M, D
	Lodgepole Pine (LPN)	4, 5	P
	Montane Riparian (MRI)	4	M, D
	Red Fir (RFR)	4, 5	P
	Subalpine Conifer (SCN)	4, 5	P
	Sierran Mixed Conifer (SMC) – Fir dominated stands only	4	M, D
	Sierran Mixed Conifer (SMC) – Pine dominated stands only	5, 6	M, D

Within the Sagehen Wildlife analysis area, there is a total of 29,467 acres of which 75% (22,237 ac) is on National Forest System lands (NFS) and 25% (7,230 ac) is in private ownership (Table 35). Of the total National Forest System lands in the analysis area, 14% is high quality marten habitat; 9% is moderate quality marten habitat; and 76% is not suitable, based on the habitat suitability criteria as shown in Table 34.

Table 35. Acres of Suitable High and Moderate Quality Marten Habitat within Wildlife Analysis Area by Ownership

Habitat Suitability	Analysis Area Acres	Forest Service			Private		
		Acres	% Habitat FS lands (22,237)	% FS Habitat in Analysis Area (29,467 ac)	Acres	% Habitat PVT lands (7,230 ac)	% PVT Habitat in Analysis Area (29,467 ac)
High Quality	5,218	3,221	15	11	1,907	26	7
Moderate Quality	2,986	2,086	9	7	900	12	3
Not Suitable	21,353	16,930	76	57	4,423	61	15
Total	**29,467**	**22,237**	**100%**	**75**	**7,230**	**100**	**25**

Table 36 displays the acres of suitable goshawk habitat by CWHR vegetation type, tree size class and canopy cover on Forest Service and private lands within the analysis area. The amount and type of suitable habitat in Table 34 reflects the existing current condition and for Alternative 2, No Action.

Table 36. Marten Habitat Suitability within the 29,467-acre Analysis Area

CWHR Vegetation Type	CWHR Tree Size	CWHR Canopy Cover Class	Forest Service (Acres)	Private (Acres)
High Quality Habitat				
LPN	4	D	488.7	10.6
LPN	4	M	187.1	51.9
LPN	5	D	1.7	0.0
LPN	5	M	0	54.0
RFR	4	D	536.2	79.8
RFR	4	M	565.1	293.0
RFR	5	D	16.6	6.6
RFR	5	M	152.7	103.7
RFR	6	D	63.1	13.4
SCN	4	M	54.8	25.3
SCN	5	M	10.3	0.0
SMC	5	D	5.3	45.3
SMC	5	M	14.8	28.4
SMC	6	D	2.1	7.0
WFR	4	D	503.5	283.7
WFR	4	M	454.8	449.5
WFR	5	D	74.2	73.9
WFR	5	M	33.6	368.3
WFR	6	D	56.3	13.5
Total			**3,220.95**	**1,907.8**
Moderate Quality Habitat				

EPN	5	D	5.0	0.0
EPN	5	M	64.8	8.6
EPN	6	D	13.6	0.0
JPN	5	D	0.7	34.1
JPN	5	M	72.5	39.7
LPN	4	P	170.2	47.8
LPN	5	P	20.8	27.5
MRI	4	D	4.7	3.2
MRI	4	M	10.3	1.2
RFR	4	P	384.7	440.0
RFR	5	P	37.3	97.3
SCN	4	P	7.3	54.3
SCN	5	P	16.5	8.3
SMC – fir dominated	4	D	973.9	10.0
SMC – fir dominated	4	M	303.3	128.1
Total			**2,085.61**	**900.0**
Not Suitable				
ADS			86	0.0
BAR			250.3	204.4
BBR			637.49	28.5
EPN	1	M	6.3	0.0
EPN	1	S	5.4	0.0
EPN	1	X	96.3	0.0
EPN	2	D	20.2	0.0
EPN	2	M	22.1	0.0
EPN	2	P	100.3	0.0
EPN	2	S	242.8	4.7
EPN	3	D	309.1	0.0
EPN	3	M	175.1	2.7
EPN	3	P	319.7	0.0
EPN	3	S	232.8	0.0
EPN	4	D	826.9	9.0
EPN	4	M	888.2	71.3
EPN	4	P	1,492.4	80.7
EPN	4	S	757.8	57.4
EPN	5	P	70.9	0.1
EPN	5	S	15.1	0.0
JPN	1	S	3.9	0.0
JPN	1	X	17.0	0.0
JPN	2	D	9.6	0.0
JPN	2	M	12.8	0.0
JPN	2	P	57.3	0.0
JPN	2	S	125.8	0.0
JPN	3	D	256.0	0.0
JPN	3	M	374.4	1.0

JPN	3	P	82.2	0.0
JPN	3	S	126.1	4.2
JPN	4	D	1,426.5	10.0
JPN	4	M	1,072.3	293.3
JPN	4	P	1,184.1	156.0
JPN	4	S	403.5	75.0
JPN	5	P	39.7	18.5
JPN	5	S	12.8	0.0
LAC			4.3	703.5
LPN	3	D	182.1	0.0
LPN	3	M	32.9	0.0
LPN	3	P	59.9	0.0
LPN	3	S	20.0	3.0
LPN	4	S	77.0	4.6
LPN	5	S	0	6.2
LPN	6	D	3.6	2.6
LSG	1		3.3	0.0
MCP			1,762.2	522.5
MRI			262.5	155.7
MRI	2	M	0	87.1
MRI	3	P	0	5.2
MRI	4	P	4.5	16.5
PGS			159.8	17.3
RFR	2	M	8.6	0.0
RFR	2	P	9.5	2.2
RFR	2	S	0	1.8
RFR	3	D	19.2	0.0
RFR	3	P	21.2	142.8
RFR	3	S	26.0	8.0
RFR	4	S	214.8	155.0
RFR	5	S	0	7.3
SCN	4	S	13.7	13.1
SGB			74.1	5.1
SMC	1	S	0.9	29.4
SMC	3	D	14	0.0
SMC	3	M	17.4	0.0
SMC	3	P	29.2	0.5
SMC	3	S	62.1	16.6
SMC – pine dominated	4	D	507.1	6.9
SMC – pine dominated	4	M	312.0	0.0
SMC	4	P	373.8	40.9
SMC	4	S	88.4	9.5
SMC	5	P	125.2	107.1
SMC	5	S	24.9	61.3
URB			3.8	1.3

WFR	2	D	16.3	0.0
WFR	2	S	27.2	0.0
WFR	3	M	22.1	0.0
WFR	3	P	20.3	11.1
WFR	3	S	32.6	75.5
WFR	4	P	244.5	507.5
WFR	4	S	121.3	183.1
WFR	5	P	5.7	24.8
WFR	5	S	12.0	34.5
WTM			150.4	436.4
Total			**16,929.8**	**4,422.6**

Figure 8 depicts a map of Pacific marten high and moderate quality habitat including proposed treatments for the proposed action.

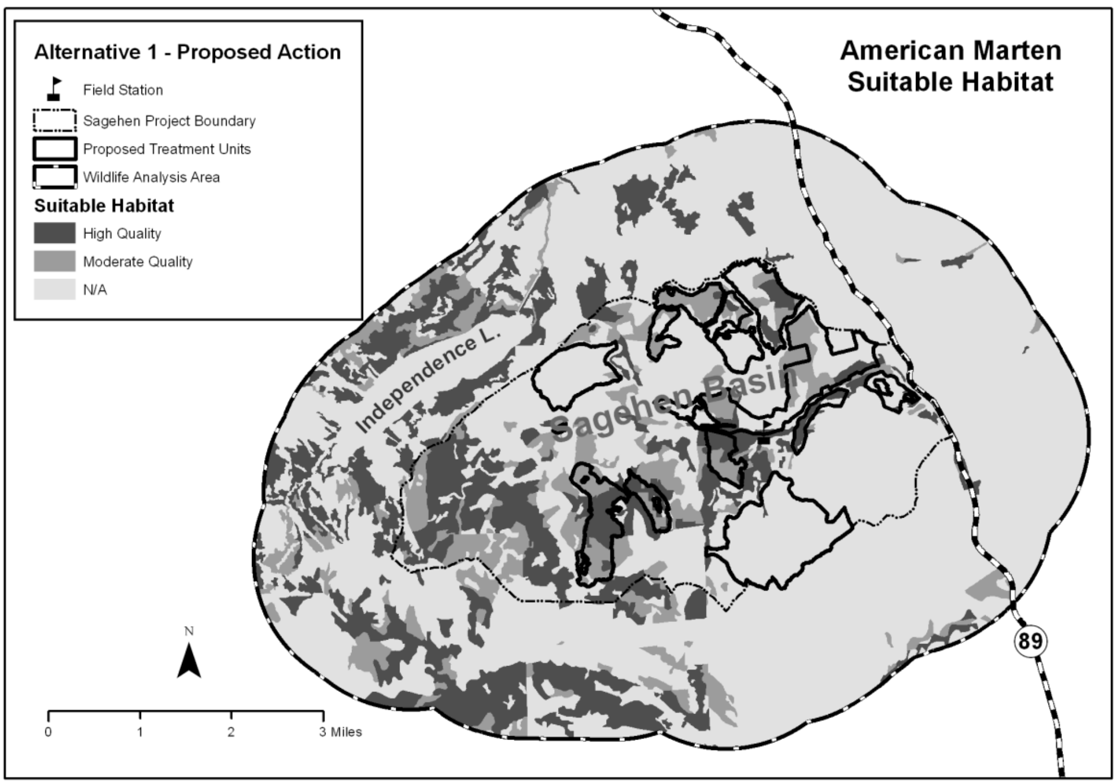

Figure 8. Pacific marten high and moderate quality habitat within the analysis area.

B. Pacific Marten: Effects of the Proposed Action and Alternatives including Project Design Standards

Assumptions used for the analysis:

- Pacific marten habitat is generally associated with mature forests (mid to late-successional forests)
- Martens are sensitive to the loss and fragmentation of mature forest habitat
- Marten habitat is important to consider at the local scale, home range scale, and landscape scale
- High quality marten habitat dominated by large trees, moderate to high canopy cover, abundance of snags and downed logs provide prey resources, resting structures, and escape cover to avoid predators.

- Martens can inhabit younger or managed forests as long as some of the structural elements found in older forests remain, particularly those required for resting and denning
- Forest management aimed at promoting forest resiliency and patch-scale heterogeneity can meet fuels and ecological restoration objectives and provide for marten habitat (North et al. 2009, North et al. 2012)
- Forest management and fuels reduction strategies using slope, topographic position and aspect that would result under a natural disturbance regime may benefit marten by reducing the risk of stand-replacement wildfires, although short-term impacts to habitat would be expected while still providing sufficient marten habitat

Direct Effects – Project Disturbance

Pacific marten inhabiting the Sagehen Basin has the potential to be directly disturbed by project activities under both Alternatives 1 and 3. Disturbance from proposed treatments could result in displacement and/or mortality to marten, or short-term changes in behavior or stress levels. Alternative 1 would have the greatest potential to disturb marten, since mechanical methods would be used and would likely create the most noise related disturbance. Alternative 3 would result in less marten disturbance compared to Alternative 1, since all treatments are hand treatments and would result in fewer acres potentially causing disturbance to the marten. Alternative 2, No Action, would not result in direct effects or disturbance to marten.

Indirect Effects - Habitat Quantity and Quality

<u>Forest Thinning</u>
The largest potential threat to marten and their habitat is the effect of forest thinning, since clear-cutting is virtually non-existent on public lands. However, harvesting on private land may still have significant effects to marten habitat availability. The effects of forest fragmentation has been reported in numerous cases in the literature, mainly describing the sensitivity of martens to the effects of forest fragmentation (Bissonette et al. 1997, Chapin et al. 1998, Hargis et al. 1999, Potvin et al. 2000 in Zielinski 2013), but in these cases, the fragmentation is typically due to regeneration or clear-cut harvests. How thinning treatments fragment habitat is poorly known, but it is under study in the Cascades in California (K. Slauson, unpubl. data; K. Moriarty, unpubl. data). Fuller and Harrison (2005) evaluated the effects of partial harvests on martens in Maine. They found martens used the partial harvest stands primarily during the summer, where 52-59 percent of the basal area was removed in partial harvests. Marten home ranges were larger when they used partial harvest stands, indicating poorer habitat quality in these areas. Partial harvested areas were avoided during the winter, presumably because they provided less overhead cover and protection from predators. How this study relates to predicting the effects of thinning in marten habitat in the Sierra Nevada is unclear, but it may suggest that martens would likely be associated with the more dense residual areas in thinned units and may also increase their home ranges, which may lead to decreased population density. The negative effects of thinning likely result from reducing overhead cover. Thinnings from below, which retain overstory cover, probably have the least impact on marten habitat, provided they retain sufficient ground cover. Downed woody debris provides important foraging habitat for martens. Andruskiw et al. (2008) found that physical complexity on or near the forest floor, which is typically provided by coarse woody debris, is directly related to predation success for martens; when this complexity is reduced by timber harvest (a combination of clear-cut and selection harvests with subsequent site preparation in their study area), predation success declines. Marten home ranges in uncut forests had 30 percent more coarse woody debris (> 10 cm diameter) from all decay classes combined than in cut forests (Andruskiw et al. 2008).

As stated above, indirect effects to marten abundance and distribution can be affected by habitat alteration from thinning and fuels treatment activities that affect canopy cover density, forest structure, understory condition, and availability of large trees. The availability of snags and down logs is also important to consider within marten and their prey species habitats. The indirect effects of the project alternatives to high and moderate quality marten habitat will be described within the Sagehen Project wildlife analysis area encompassing 29,467 acres. The metrics or considerations for analyzing indirect effects are as follows:

- Changes to CWHR Type, Size Class, and Canopy Cover
- Snags and Downed Log Abundance
- Habitat Fragmentation and Structural Diversity
- Forest
- Resiliency

Suitable high and moderate quality marten habitat were assessed for potential effects of proposed treatments for the action alternatives (Table 35). Of 2,536 acres proposed for thinning, a total 775 acres of suitable high and moderate quality habitat (232 acres – high quality, 544 acres - moderate quality) are proposed for treatment under Alternative 1. Out of 232 acres of high quality marten habitat, thinning and fuels treatments (including variable thinning, legacy tree treatments, and suppressed cutting) 133 acres of CWHR 4D would change to 4M (5D to 5M, unit 213 only), where canopy cover would be reduced below 60%. Approximately 59 acres would remain in the CWHR 4D/5M type post-treatment, and 40 acres would remain as CWHR 4M. While a short-term reduction in canopy cover would result from proposed treatments, all 232 acres would remain as high quality habitat immediately following treatments, but would result in reduced in quality in the short-term.

Of the 544 acres of moderate quality marten habitat proposed for treatment, 407 acres would change from CWHR 4D to CWHR 4M, 87 acres would remain CWHR 4M, 42 acres would change from CWHR 4D to 4P, and 8 acres would remain as CWHR 4P types post-treatment. The 42 acres that would change from CWHR 4D to 4P where post-treatment canopy cover level would fall below 40% are located within Unit 33. However, the residual canopy cover for Unit 33 would be above 40%, and therefore, Forest Plan standards and guidelines to retain suitable marten habitat >40% canopy cover would be met. Current unit average canopy cover ranges from 51% to 80% and post-treatment average canopy cover would range from 41% to 71% under Alternative 1.

Under Alternative 3, Non-commercial Alternative, a subset of Alternative 1 units (1,137 acres) would be proposed for treatment to meet fuels objectives, where 222 acres of high and moderate quality habitat (146 acres – high quality, 76 acres – moderate quality) would result in lowered canopy cover in the short term. All 222 acres of suitable marten habitat would remain suitable, but habitat quality would be lowered in the short-term. Approximately 68 acres of nesting habitat would change in CWHR type 4D to 4M, 58 acres would remain as CWHR 4D, and 21 acres would remain as CWHR 4M following treatments. The quantity of suitable high quality marten habitat would remain unchanged following hand thinning treatments and follow-up fuels treatments such as, prescribed fire and mastication where treatment involves removal of small diameter trees that would not result in a significant change in canopy cover or tree class. Proposed treatments of moderate quality habitat would change from CWHR 4D to CWHR 4M on 21 acres, remain as CWHR 4D on 41 acres, remain as CWHR 4M on 10 acres, and 4 acres would stay as CWHR 4P post-treatment.

Under Alternative 3, the opportunity to increase and enhance forest resiliency and structure diversity would not be achieved on approximately 1,399 acres that are proposed for treatment under Alternative 1. Legacy tree treatments and decadent feature enhancements that would enhance and increase course woody debris important for marten denning and resting would not be realized. Enhancing marten prey habitat by creating landscape level heterogeneity from early seral openings and decadent feature enhancements on 1,399 acres would not occur in mechanical thinning units. The average unit canopy cover for Alternative 3 currently ranges from 51% to 76%. Average canopy cover for the units following treatments would range from 41% to 71%.

Under Alternative 2, No Action, 2,563 acres, including 775 acres of high and moderate quality marten habitat would not be treated and therefore, canopy cover would not change or be reduced in quality. However, forest resiliency, forest structural diversity, and reduced fuels hazard would not be realized under the No Action Alternative. Stand density reduction would not occur and therefore, legacy tree treatments that would promote the growth and protection of large, old trees important for marten denning, resting, and foraging would not be achieved in the long-term. In the long-term, marten denning and foraging habitat throughout the Sagehen Basin would remain at a higher risk of severe wildfire effects under the No Action Alternative.

Table 37. Current and Post-Treatment CWHR Habitat Acres within High and Moderate Quality Marten Habitat by Unit									
Alternative 1									
Unit	Unit Acres	High Quality Marten Habitat			Moderate Quality Marten Habitat			Unit Average Canopy Cover	
		Acres	Current CWHR type, size, Canopy Cover Class	Post-treatment CWHR type, size, Canopy Cover Class	Acres	Current Tree Size and Canopy Cover Class	Post-treatment Tree Size and Canopy Cover Class	Current Canopy Cover	Post-Treatment Canopy Cover
33	118	4	RFR4D	RFR4M	37	SMC4D	SMC4M	71%	44%
					32	SMC4D	SMC4P		
34	68	0	None	None	33	SMC4D	SMC4M	70%	53%
					1	SMC4M	SMC4M		
35	64	6	LPN4D	LPN4M	15	SMC4D	SMC4M	68%	47%
					6	SMC4M	SMC4M		
36	101	0	None	None	0	None	None	75%	50%
38	210	31	WFR4D	WFR4M	47	SMC4D	SMC4M	63%	52%
		19	WFR4M	WFR4M					
46	621	0.4	LPN4D	LPN4M	0	None	None	51%	41%
		4	(RFR, LPN) 4M	(RFR, LPN)4M					
47	33	0	None	None	0	None	None	51%	46%
61	20	20	(LPN,WFR) 4D	(LPN,WFR) 4D	0	None	None	74%	64%
73	144	0	None	None	66	SMC4D	SMC4M	72%	51%
					21	SMC4M	SMC4M		
76	91	0.1	LPN4D	LPN4M	2	SMC4D	SMC4M	56%	43%
80	5	0	None	None	5	SMC4D	Aspen 4M	>60%	40-60%
85	64	0	None	None	5	SMC4D	SMC4M	62%	56%
87	206	0	None	None	0	None	None	60%	46%
89	34	0	None	None	2	SMC4D	SMC4M	80%	56%
90	40	0.10	LPN4D	LPN4M	31	SMC4D	LPN4M	78%	51%
					4	SMC4M	SMC4M		

91	9	6	LPN4D	LPN4M	1	SMC4D	SMC4M	62%	58%
		1.5	LPN4M	LPN4M					
98	63	45	LPN4D	LPN4M	0	None	None	59%	40%
99	67	11	LPN4D	LPN4D	0.6	LPN4P	LPN4P	59%	63%
100	120	27	LPN4D	LPN4D	41	SMC4D	SMC4D	64%	60%
					10	SMC4M	SMC4M		
					3.5	LPN4P	LPN4P		
163	82	24	(LPN, WFR) 4D	(LPN, WFR) 4M	39	SMC4D	SMC4M	66%	50%
					13	SMC4M	SMC4M		
					4	LPN4P	LPN4P		
213	268	1	SMC5D	SMC5D	111	(LPN, WFR, RFR) 4D	(LPN, WFR, RFR) 4M	68%	55%
		0.05	SMC5D	SMC5M	1	(LPN, WFR, RFR) 4M	(LPN, WFR, RFR) 4M		
282	108	16	LPN4D	LPN4M	13	SMC4D	SMC4D	76%	59%
		15	LPN4M	LPN4M					
Totals	**2,536**	**231**			**544**				

Alternative 3*

Unit	Unit Acres	High Quality Marten Habitat			Moderate Quality Marten Habitat			Unit Average Canopy Cover	
		Acres	Current CWHR Type, Size, and Canopy Cover Class	Post-treatment CWHR Type, Size, and Canopy Cover Class	Acres	Current Tree Size and Canopy Cover Class	Post-treatment Tree Size and Canopy Cover Class	Current Canopy Cover	Post-Treatment Canopy Cover
46	621	0.4	LPN4D	LPN4M	0	None	None	51%	41%
		4	(RFR, LPN)4M	(RFR, LPN)4M					
47	33	0	None	None	0	None	None	51%	47%
61	20	20	(LPN,WFR)4D	(LPN,WFR)4D	0	None	None	74%	64%
76	91	0.1	LPN4D	LPN4M	2	SMC4D	SMC4M	56%	43%
80	5	0	None	None	5	SMC4D	ASPEN4M	>60%	40-60%
91	9	6	LPN4D	LPN4M	1	SMC4D	SMC4M	62%	58%

		1.5	LPN4M	LPN4M					
98	63	45	LPN4D	LPN4M	0	None	None	59%	40%
99	67	11	LPN4D	LPN4D	0.6	LPN4P	LPN4P	59%	63%
100	120	27	LPN4D	LPN4D	41	SMC4D	SMC4D	64%	60%
					10	SMC4M	SMC4M		
					3.5	LPN4P	LPN4P		
282	108	16	LPN4D	LPN4M	13	SMC4D	SMC4D	76%	59%
		15	LPN4M	LPN4M					
Totals	**1,137**	**146**			**76**				

Alternative 3* - No treatment in Units 33, 34, 35, 36, 38, 39, 73,85, 87, 156, 163, 213

Table 38. Acre Summary of Post-treatment Changes by CWHR Type, Size and Canopy Classes within High and Moderate Quality Marten Habitat by Unit

Alternative 1

Unit	Unit Acres	High Quality Marten Habitat			Moderate Quality Marten Habitat			
		Post-treatment Acres of Changes in CWHR Class 4D to 4M)(Unit 213 only - 5D to 5M)	CWHR Class Unchanged - 4D/5D Remaining 4D/5D (Acres)	Post-treatment Acres of CWHR Class Unchanged 4M Remaining 4M)	Post-treatment Acres of Changes in CWHR Class (4D to 4M)	Post-treatment Acres of CWHR Class Unchanged (4M remaining 4M)	Post-treatment Acres of Changes in CWHR Class (4D to 4P)	Post-treatment Acres of CWHR Class Unchanged (4P to 4P)
33	118	4.0	0.0	0.0	37.0	0.0	32.0	0.0
34	68	0.0	0.0	0.0	33.0	1.0	0.0	0.0
35	64	6.0	0.0	0.0	15.0	6.0	0.0	0.0
36	101	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	210	31.0	0.0	19.0	47.0	0.0	0.0	0.0
46	621	0.4	0.0	4.0	0.0	0.0	0.0	0.0
47	33	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	20	0.0	20.0	0.0	0.0	0.0	0.0	0.0
73	144	0.0	0.0	0.0	66.0	21.0	0.0	0.0
76	91	0.1	0.0	0.0	2.0	0.0	0.0	0.0
80	5	0.0	0.0	0.0	5.0	0.0	0.0	0.0

85	64	0.0	0.0	0.0	5.0	0.0	0.0	0.0
87	206	0.0	0.0	0.0	0.0	0.0	0.0	0.0
89	34	0.0	0.0	0.0	2.0	0.0	0.0	0.0
90	40	0.1	0.0	0.0	31.0	4.0	0.0	0.0
91	9	6.0	0.0	1.5	1.0	0.0	0.0	0.0
98	63	45.0	0.0	0.0	0.0	0.0	0.0	0.0
99	67	0.0	11.0	0.0	0.0	0.0	0.0	0.6
100	120	0.0	27.0	0.0	0.0	41.0	10.0	3.5
163	82	24.0	0.0	0.0	39.0	13.0	0.0	4.0
213	268	0.1	1.0	0.0	111.0	1.0	0.0	0.0
282	108	16.0	0.0	15.0	13.0	0.0	0.0	0.0
Total	**2,536**	**132.7**	**59.0**	**39.5**	**407.0**	**87.0**	**42.0**	**8.1**

Alternative 3								
		High Quality Marten Habitat			Moderate Quality Marten Habitat			
Unit	Unit Acres	Changes in CWHR Class - 4D to 4M (Acres)	CWHR Class Unchanged - 4D Remaining 4D (Acres)	CWHR Class Unchanged - 4M Remaining 4M (Acres)	Changes in CWHR Class - 4D to 4M (Acres)	CWHR Class Unchanged 4D Remaining 4D (Acres)	CWHR Class Unchanged - 4M Remaining 4M (Acres)	CWHR Class Unchanged 4P to 4P (Acres)
46	621	0.4	0.0	4.0	0.0	0.0	0.0	0.0
47	33	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	20	0.0	20.0	0.0	0.0	0.0	0.0	0.0
76	91	0.1	0.0	0.0	2.0	0.0	0.0	0.0
80	5	0.0	0.0	0.0	5.0	0.0	0.0	0.0
91	9	6.0	0.0	1.5	1.0	0.0	0.0	0.0
98	63	45.0	0.0	0.0	0.0	0.0	0.0	0.0
99	67	0.0	11.0	0.0	0.0	0.0	0.0	0.6
100	120	0.0	27.0	0.0	0.0	41.0	10.0	3.5
282	108	16.0	0.0	15.0	13.0	0.0	0.0	0.0
Totals	**1,137**	**67.5**	**58.0**	**20.5**	**21.0**	**41.0**	**10.0**	**4.1**

Dense Cover Areas (DCAs) and Early Seral Openings (ESOs) in Suitable Marten Habitat

Acres of Dense Cover Areas (DCAs) and Early Seral Openings (ESOs) within mechanical treatment units are shown in Tables 39 and 40 by CWHR types and marten habitat suitability for Alternative 1. DCAs are areas that are delineated within treatment areas that will remain intact and provide high to moderate quality marten habitat which typically provide areas of higher canopy cover and larger trees compared to the surrounding areas. Alternative 1 proposes to delineate a total of 78 acres of DCAs, of which 15 acres are not suitable, 28 acres are high quality, and 36 acres are moderate quality habitat for the marten.

Alternative 1 proposes to create a total of 54 acres of ESOs, of which 15 acres are not suitable, 11 acres are high quality, and 29 acres are moderate quality marten habitat (Table 40). Emphasis areas 1 and 2 represent areas that currently have higher amounts of high and moderate quality marten habitat. Approximately 13 acres of ESO's are proposed within emphasis area 1. No ESOs are proposed within emphasis areas 2 or 4 that occur along the drainage bottoms. These ESOs are roughly ¼ to ½ acre in size and would be scattered throughout these emphasis area 1. The ESOs would result in removal of all existing trees and would eventually be planted or naturally regenerate over time. Therefore, the CWHR vegetation class in ESOs would likely remain the same as the current existing vegetation following treatment. However, the CWHR tree size and canopy classes would be reverted to early seral openings following treatments, as all trees would be removed. Moreover, it is expected that the ESOs would eventually become forested and not result in long-term type conversion. Additionally, the ESOs would not alter or change the marten habitat suitability across the treatment units or would not result in habitat fragmentation at the landscape level, particularly since small localized openings would not increase the distance between suitable habitat patches. In the Rocky Mountains, the average width of clear cuts (openings) crossed by martens was 460 ft; this distance is significantly greater than the size of early seral openings proposed for the Sagehen Project.

These DCAs and ESOs combined with variable thinning, legacy tree treatments, suppressed thinning, and associated fuels treatments would result in a more diverse and resilient landscape within suitable marten habitat, although localized effects from the treatments would vary depending upon site-specific conditions.

Both Alternatives 1 and 3 would designate a total of 28 acres of DCAs within fuels treatment (units 61, 91, 98, 99, 100, 282). Out of 573 acres of fuels treatment acres in these units, 134 acres (23%) are high quality marten habitat and 70 acres (12%) are moderate quality marten habitat. It can be assumed that the DCAs represent a relatively similar proportion of high and moderate quality habitat within the fuels treatment units, since specific habitat data for DCAs within fuels treatment units was not available for this analysis. Under Alternative 3, increased structural diversity from DCAs would only occur across 1,132 fuels treatment acres compared to the 1,664 acres in Alternative 1 (Units 33, 34, 35, 36, 38, 61, 73, 85, 89, 90, 91, 156, 163, 213, and 282) where the combination of DCAs and ESOs would contribute to more resilient forests and heterogeneity across the landscape. Alternative 2 would provide no change in forest structural diversity across the landscape, but would have the least impacts to marten habitat in the short-term since no ESOs would be created where all the trees would be harvested.

Table 39. Acres of Dense Cover Areas in Mechanical Treatment Units by CWHR Type and High and Moderate Quality Marten Habitat

Unit	Emphasis Area	CWHR Type	Dense Cover Areas (Acres)	Not Suitable (Acres)	High Quality (Acres)	Moderate Quality (Acres)
33	1	RFR4D	1.04	0.00	1.04	0.00
		SMC4D - fir dominated	0.04	0.00	0.00	0.04
	4	RFR4D	0.03	0.00	0.03	0.00
		SMC4D - fir dominated	2.92	0.00	0.00	2.92
		SMC4M - fir dominated	0.02	0.00	0.00	0.02
		SMC3S	0.07	0.07	0.00	0.00
	5	SMC4D - fir dominated	2.09	0.00	0.00	2.09
		SMC4P	0.19	0.19	0.00	0.00
	6	SMC4D - fir dominated	1.82	0.00	0.00	1.82
		SMC4M - fir dominated	0.01	0.00	0.00	0.01
		SMC4P	0.02	0.02	0.00	0.00
34	5	SMC4D - fir dominated	1.43	0.46	0.00	0.97
		SMC3P	0.03	0.03	0.00	0.00
	6	SMC4D - fir dominated	1.36	0.42	0.00	0.94
35	1	LPN4D	1.47	0.00	1.47	0.00
	6	SMC4D - fir dominated	0.57	0.00	0.00	0.57
		SMC4P	0.46	0.46	0.00	0.00
36	4	SMC4D - pine dominated	0.98	0.98	0.00	0.00
		SMC4M - pine dominated	0.56	0.56	0.00	0.00

		SMC4P	0.01	0.01	0.00	0.00
	5	SMC4D - pine dominated	0.81	0.81	0.00	0.00
		SMC4M - pine dominated	0.18	0.18	0.00	0.00
	6	SMC4D - pine dominated	0.65	0.65	0.00	0.00
		SMC4M - pine dominated	1.24	1.24	0.00	0.00
38	1	SMC4D - fir dominated	0.62	0.00	0.00	0.62
		SMC4M - pine dominated	0.14	0.14	0.00	0.00
		WFR4D	2.69	0.00	2.69	0.00
		WFR4M	4.09	0.00	4.09	0.00
	4	SMC4M - pine dominated	0.48	0.48	0.00	0.00
	5	EPN4S	0.16	0.16	0.00	0.00
		JPN4P	0.16	0.16	0.00	0.00
		SMC4D - fir dominated	2.90	0	0.00	2.90
		SMC4M - pine dominated	1.06	1.06	0.00	0.00
	7	JPN4P	0.26	0.26	0.00	0.00
		WFR4M	0.22	0	0.22	0.00
73	4	JPN4D	0.07	0.07	0.00	0.00
		JPN4M	0.97	0.97	0.00	0.00
	5	JPN4M	0.12	0.12	0.00	0.00
		SMC4D - fir dominated	5.08	0	0.00	5.08
		SMC4M - fir dominated	0.66	0	0.00	0.66
	6	JPN4S	0.04	0.04	0.00	0.00
		SMC4D - fir dominated	0.43	0.00	0.00	0.43
85	5	JPN3M	0.01	0.01	0.00	0.00
		JPN4P	0.68	0.68	0.00	0.00

	6	JPN3P	0.56	0.56	0.00	0.00
		JPN4P	1.01	1.01	0.00	0.00
		JPN4S	0.34	0.34	0.00	0.00
		SMC4D	0.01	0.00	0.00	0.01
89	4	JPN4D	0.26	0.26	0.00	0.00
		JPN4M	0.07	0.07	0.00	0.00
		JPN4P	0.16	0.16	0.00	0.00
		JPN4S	0.07	0.07	0.00	0.00
		SMC4D	0.05	0.00	0.00	0.05
	6	JPN4D	1.13	1.13	0.00	0.00
90	6	JPN4P	0.07	0.07	0.00	0.00
		SMC4D	1.06	0.00	0.00	1.06
156	1	LPN4D	0.07	0.00	0.07	0.00
		RFR4M	0.67	0.00	0.67	0.00
		SMC4D	2.52	0.00	0.00	2.52
		WFR4D	1.42	0.00	1.42	0.00
		WFR4M	1.50	0.00	1.50	0.00
163	1	SMC4M	0.02	0.00	0.00	0.02
		WFR4D	4.16	0.00	4.16	0.00
	5	LPN4P	0.69	0.00	0.00	0.69
		SMC4D	2.03	0.00	0.00	2.03
213	1	RFR4D	7.82	0.00	7.82	0.00
		RFR4M	0.01	0.00	0.01	0.00
		RFR4P	1.29	0.00	0.00	1.29
		SMC4D	4.35	0.00	0.00	4.35
		SMC4P	0.72	0.72	0.00	0.00
		SMC4S	0.21	0.21	0.00	0.00
		WFR4D	1.42	0.00	1.42	0.00
		WFR4S	0.01	0.01	0.00	0.00
	2	RFR4D	0.30	0.00	0.30	0.00

		WFR4D	0.70	0.00	0.70	0.00
	4	ADS	0.40	0.40	0.00	0.00
		SMC4D	2.67	0.00	0.00	2.67
	5	SMC4D	0.86	0.00	0.00	0.86
	6	SMC4D	0.90	0.00	0.00	0.90
		WFR4D	0.01	0.00	0.01	0.00
Total			**78.38**	**15.24**	**27.62**	**35.52**

Table 40. Acres of Early Seral Openings in Mechanical Treatment Units by CWHR Type and High and Moderate Quality Marten Habitat

Unit	Emphasis Area	Current CWHR	Early Seral Openings (Acres)	Not Suitable (Acres)	High Quality Habitat (Acres)	Moderate Quality Habitat (Acres)	Post-Treatment CWHR	Post-Treatment Suitability within ESO	Post-Treatment Suitability across Emphasis Area
33	5	SMC3P	0.23	0.23	0.00	0.00	SMC – ESO	Not Suitable	Not Suitable
		SMC4D – fir dominated	1.70	0.00	0.00	1.70	SMC – ESO	Not Suitable	Moderate Quality
		SMC4M – fir dominated	0.09	0.00	0.00	0.09	SMC – ESO	Not Suitable	Moderate Quality
	6	SMC4D – fir dominated	3.19	0.00	0.00	3.19	SMC – ESO	Not Suitable	Moderate Quality
		SMC4M – fir dominated	0.88	0.00	0.00	0.88	SMC – ESO	Not Suitable	Moderate Quality
34	5	SMC4D – fir dominated	0.93	0.00	0.00	0.93	SMC – ESO	Not Suitable	Moderate Quality
	6	SMC4D - pine dominated	0.40	0.40	0.00	0.00	SMC – ESO	Not Suitable	Not Suitable
		SMC4D – fir dominated	1.10	0.00	0.00	1.10	SMC – ESO	Not Suitable	Moderate Quality
		SMC4P	0.46	0.46	0.00	0.00	SMC – ESO	Not Suitable	Not Suitable
	7	SMC4D - pine dominated	0.53	0.53	0.00	0.00	SMC – ESO	Not Suitable	Not Suitable
35	5	SMC4D – fir dominated	0.54	0.00	0.00	0.54	SMC – ESO	Not Suitable	Moderate Quality

	6	SMC4D – fir dominated	1.09	0.00	0.00	1.09	SMC – ESO	Not Suitable	Moderate Quality
		SMC4M – pine dominated	0.19	0.19	0.00	0.00	SMC – ESO	Not Suitable	Not Suitable
		SMC4P	0.76	0.76	0.00	0.00	SMC – ESO	Not Suitable	Not Suitable
	7	SMC4D – fir dominated	0.32	0.00	0.00	0.32	SMC – ESO	Not Suitable	Moderate Quality
36	5	SMC4D – pine dominated	0.36	0.36	0.00	0.00	SMC – ESO	Not Suitable	Not Suitable
	6	JPN4P	0.11	0.11	0.00	0.00	JPN - ESO	Not Suitable	Not Suitable
		SMC4D - pine dominated	1.47	1.47	0.00	0.00	SMC – ESO	Not Suitable	Not Suitable
		SMC4M – pine dominated	1.69	1.69	0.00	0.00	SMC – ESO	Not Suitable	Not Suitable
	7	SMC4D – pine dominated	0.61	0.61	0.00	0.00	SMC – ESO	Not Suitable	Not Suitable
		SMC4M - pine dominated	0.10	0.10	0.00	0.00	SMC – ESO	Not Suitable	Not Suitable
		SMC4P	0.37	0.37	0.00	0.00	SMC – ESO	Not Suitable	Not Suitable
38	1	SMC4D – fir dominated	0.50	0.00	0.00	0.50	SMC – ESO	Not Suitable	Moderate Quality
		WFR4D	1.86	0.00	1.86	0.00	WFR - ESO	Not Suitable	High Quality
		WFR4M	0.94	0.00	0.94	0.00	WFR - ESO	Not Suitable	High Quality
	5	SMC4D – pine dominated	1.29	1.29	0.00	0.00	SMC - ESO	Not Suitable	Not Suitable
		SMC4D - fir dominated	2.46	0.00	0.00	2.46	SMC - ESO	Not Suitable	Moderate Quality
		SMC4M – pine dominated	0.34	0.34	0.00	0.00	SMC - ESO	Not Suitable	Not Suitable
	7	JPN4P	0.60	0.60	0.00	0.00	JPN - JPN	Not Suitable	Not Suitable
		SMC4D – pine dominated	0.44	0.44	0.00	0.00	SMC - ESO	Not Suitable	Not Suitable
		SMC4D – fir dominated	0.53	0.00	0.53	0.00	SMC - ESO	Not Suitable	High Quality
		SMC4M – pine dominated	0.84	0.84	0.00	0.00	SMC - ESO	Not Suitable	Not Suitable
		SMC4P	0.36	0.36	0.00	0.00	SMC - ESO	Not Suitable	Not Suitable
		WFR4M	0.25	0.00	0.25	0.00	WFR - ESO	Not Suitable	High Quality

73	5	SMC4D – fir dominated	2.91	0.00	0.00	2.91	SMC - ESO	Not Suitable	Moderate Quality
		SMC4M – fir dominated	1.45	0.00	0.00	1.45	SMC - ESO	Not Suitable	Moderate Quality
	6	SMC4D – fir dominated	1.59	0.00	0.00	1.59	SMC - ESO	Not Suitable	Moderate Quality
	7	JPN5P	0.48	0.48	0.00	0.00	JPN - ESO	Not Suitable	Not Suitable
85	5	SMC4D – fir dominated	0.44	0.00	0.00	0.44	SMC - ESO	Not Suitable	Moderate Quality
		JPN3P	0.01	0.01	0.00	0.00	JPN - ESO	Not Suitable	Not Suitable
	6	JPN4P	1.83	1.83	0.00	0.00	JPN - ESO	Not Suitable	Not Suitable
		JPN4S	0.01	0.01	0.00	0.00	JPN - ESO	Not Suitable	Not Suitable
		SMC4D – fir dominated	0.50	0.00	0.00	0.50	SMC - ESO	Not Suitable	Moderate Quality
89	6	JPN4D	1.36	1.36	0.00	0.00	JPN - ESO	Not Suitable	Not Suitable
		JPN4P	0.05	0.05	0.00	0.00	JPN - ESO	Not Suitable	Not Suitable
90	6	SMC4D – fir dominated	1.21	0.00	0.00	1.21	SMC - ESO	Not Suitable	Not Suitable
156	1	SMC4D – fir dominated	0.91	0.00	0.00	0.91	SMC - ESO	Not Suitable	Moderate Quality
		WFR4D	0.51	0.00	0.51	0.00	SMC - ESO	Not Suitable	Moderate Quality
		WFR4M	0.58	0.00	0.58	0.00	WFR - WFR	Not Suitable	High Quality
163	1	LPN4D	0.48	0.00	0.48	0.00	LPN - ESO	Not Suitable	High Quality
		WFR4D	1.47	0.00	1.47	0.00	WFR - ESO	Not Suitable	High Quality
	5	SMC4D – fir dominated	1.54	0.00	0.00	1.54	SMC - ESO	Not Suitable	High Quality
		SMC4M – fir dominated	0.54	0.00	0.00	0.54	SMC - ESO	Not Suitable	Moderate Quality
	7	SMC4M – fir dominated	0.50	0.00	0.00	0.50	SMC - ESO	Not Suitable	Moderate Quality
213	1	RFR4D	2.71	0.00	2.71	0.00	RFR - ESO	Not Suitable	Moderate Quality
		RFR4P	1.31	0.00	0.00	1.31	RFR - ESO	Not Suitable	High Quality
		WFR4D	1.58	0.00	1.58	0.00	WFR - ESO	Not Suitable	Moderate Quality
	5	SMC4D –	0.72	0.00	0.00	0.72	SMC - ESO	Not Suitable	High Quality

		fir dominated							
		SMC4M – fir dominated	0.30	0.00	0.00	0.30	SMC - ESO	Not Suitable	Moderate Quality
	6	SMC4D – fir dominated	0.87	0.00	0.00	0.87	SMC - ESO	Not Suitable	Moderate Quality
	7	SMC4D – fir dominated	0.66	0.00	0.00	0.66	SMC - ESO	Not Suitable	Moderate Quality
		SMC4M – fir dominated	0.34	0.00	0.00	0.34	SMC - ESO	Not Suitable	Moderate Quality
Total			**54.39**	**14.89**	**10.91**	**28.59**			

Snags and Down Logs

Snags and down logs were analyzed in the section *Effects Common to All Wildlife*. Generally, Alternative 1 would maintain all existing snags >15 inch dbh, except for those needing to be removed for equipment operability or those that pose a risk public safety. It is expected that there would be no measurable difference in the number of snags greater than 15 inches dbh between the existing condition and the immediate post treatment condition.

The Forest Vegetation Simulator model projected that Alternative 1 would result in lower snag abundance compared to Alternatives 2 and 3 within 30 and 50 years after treatment. Generally, Alternative 2 would result in the most snags compared to Alternatives 1 and 3, 30 and 50 years post-treatment. In all cases, the snag densities projected at 30 and 50 years post-treatment would retain snag densities per Forest Plan standards and guidelines throughout the Sagehen Basin under all the alternatives. Under Alternative 2, the opportunity to create denning habitat structures from decadent feature enhancements (creating short snags and partial tree girdling) would not occur on 2,563 acres, including 775 acres of suitable marten habitat.

Habitat Fragmentation and Connectivity

Several studies on marten suggest that marten are extremely sensitive to habitat fragmentation. Habitat Fragmentation to the marten should be addressed at three spatial scales: 1) local site, 2) home range, and 3) landscape scale. Within the 29,467-acre analysis area, approximately 24% is high and moderate quality marten habitat (Moriarity, as modified), with the remaining 76% is either not suitable or only marginally suitable.

The Sagehen Project was specifically designed for wildlife habitat enhancement, particularly for the marten as well as other mature and late-seral associated species, such as the goshawk and the spotted owl. Proposed forest thinning and fuels treatments under Alternatives 1 and 3 are not expected to increase or contribute to marten habitat fragmentation as there would be no reduction or removal of high and moderate quality habitat, although there would be short-term reduction in habitat quality on 775 acres of suitable habitat affecting both overstory and understory components. Alternative 3 would affect fewer habitat acres than Alternative 1. Desired canopy cover, large tree distribution, and coarse wood would be maintained throughout the project units and within suitable marten habitat.

Early seral openings would not fragment habitat as they are small (0.25 and 0.5 acres) and would not restrict marten movement. Openings would be scattered throughout proposed treatment units under Alternative 1 and would not compromise suitable habitat capability for the marten (none in Alternative 3). Individual openings would likely enhance marten prey base through increased forage production. These openings would also contribute to forest structural diversity and heterogeneity.

The maintenance and enhancement of large and old trees that are important to marten would be provided throughout treatment units. In a similar fashion, coarse woody debris (logs and snags) would be maintained as well as enhanced through the development and creation of short snags and partial tree girdling.

The Sagehen Basin is within the Tahoe NF Forest Carnivore Network, which was developed to provide connectivity for Forest Carnivores at the landscape level. The Carnivore Network was modeled using suitable habitat criteria for the marten and was based on the home range of the marten. As such, connectivity within the Carnivore Network would be maintained throughout the Basin, within the greater 29,467 acre-analysis area, and within the Carnivore Network.

<u>Changes in Marten Habitat</u>

The maps shown in Figures 9 and 10 display the amount and distribution of high, moderate, and low quality marten habitat for existing and immediately post-treatment within the Basin. There are a total of 3,679 acres of existing high and moderate quality marten habitat and 3,595 acres immediately post-treatment. The reduction of high quality habitat is primarily attributed to treatments that would move to moderate quality habitat or moderate quality moving into low quality habitat in the short-term. Habitat that moves into the low quality habitat classification falls within portions of certain units where canopy cover dropped slightly below 40% (not across the entire unit). For example, canopy cover would change from 56% to 38% within emphasis area 6 of Unit 33. However, the weighted unit average canopy cover would be 44% across the entire 118 acres within Unit 33 (See Silviculture Report, Table 16, p. 78), and therefore, the resulting CWHR type would be 4M or moderate quality for that entire unit.

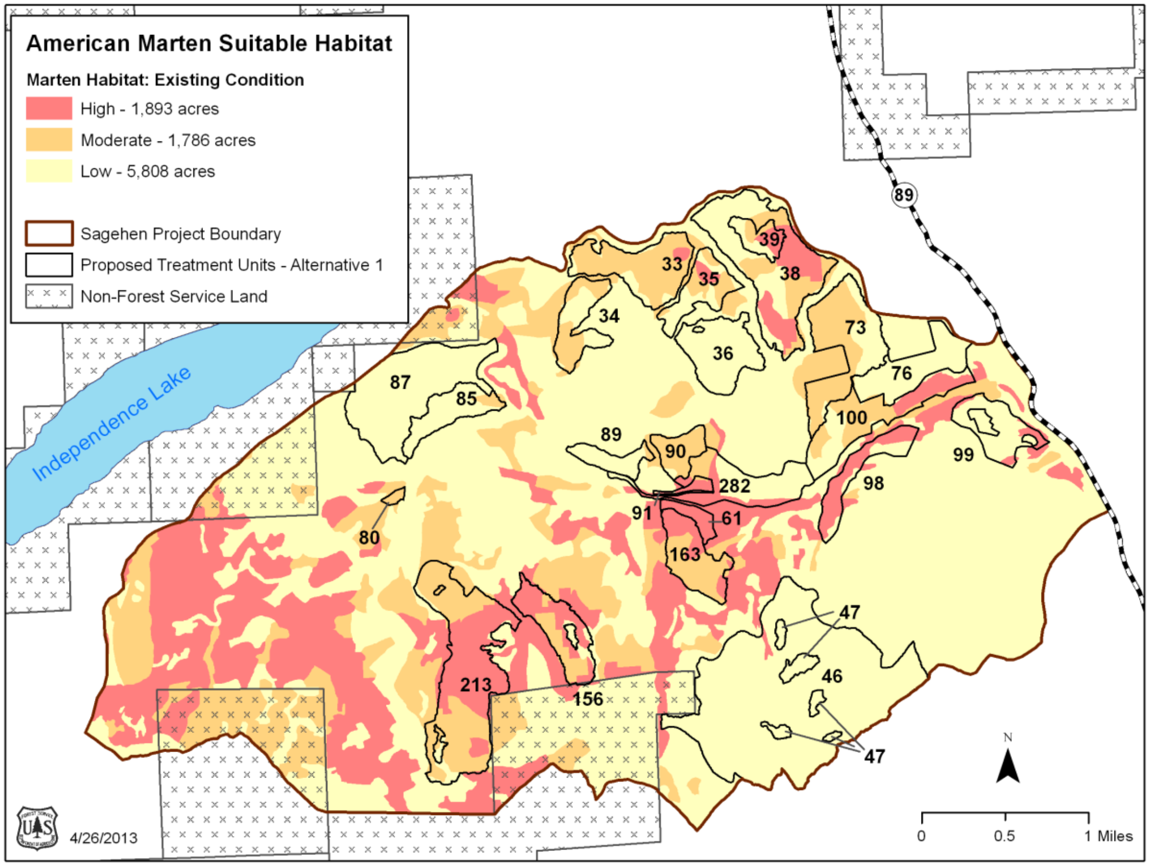

Figure 9. Existing Marten Habitat within Sagehen Basin

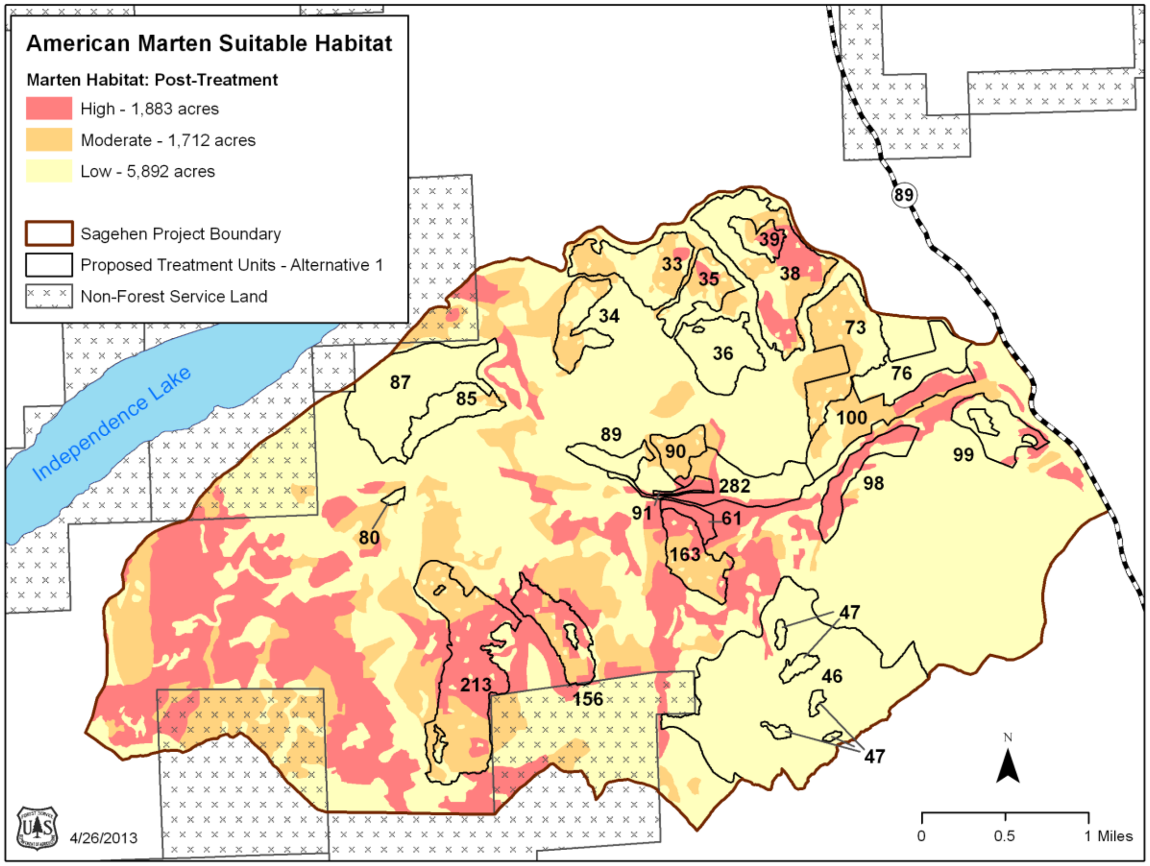

Figure 10. Post-Treatment Marten Habitat within Sagehen Basin

The Table 41 shows the changes to existing habitat marten habitat within proposed treatment units for Alternative 1, immediately post-treatment and 30 years after treatment. Initially, high quality habitat changes from 433 acres to 423 acres, but increases to 521 acres 30 years later, indicating an overall increase of 88 acres of high quality habitat compared to existing conditions. A similar trend follows for moderate quality habitat where 650 acres moderate quality habitat is reduced to 576 acres initially, but increases to 615 acres 30 years after treatment. After 30 years, high quality habitat, important for marten denning, increases by a net of 88 acres.

Table 41. Acres of Marten Habitat within Treatment Units for Existing Condition, Post-Treatment, and 30 Years Post-Treatment (Alternative 1)

Marten Habitat Quality	Existing (Acres)	Post-Treatment (Acres)	30 Years Post-Treatment (Acres)	Net Change 30 Years Post-treatment (Acres)
High	433	423	521	+88
Moderate	650	576	615	-35
Low	1,568	1,653	1,515	-53

The next three maps (Figure 11, 12, 13) display the distribution and amount of marten habitat within the treatment units for existing conditions, immediately post-treatment, and 30 years after treatment.

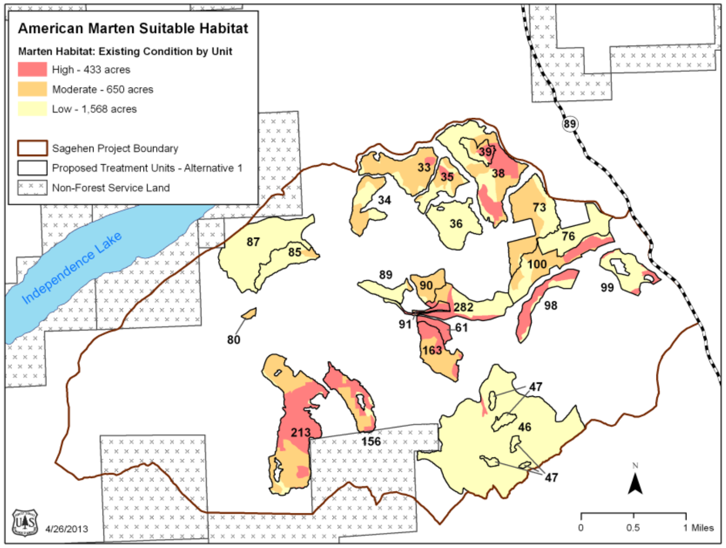

Figure 11. Existing Marten Habitat by Unit

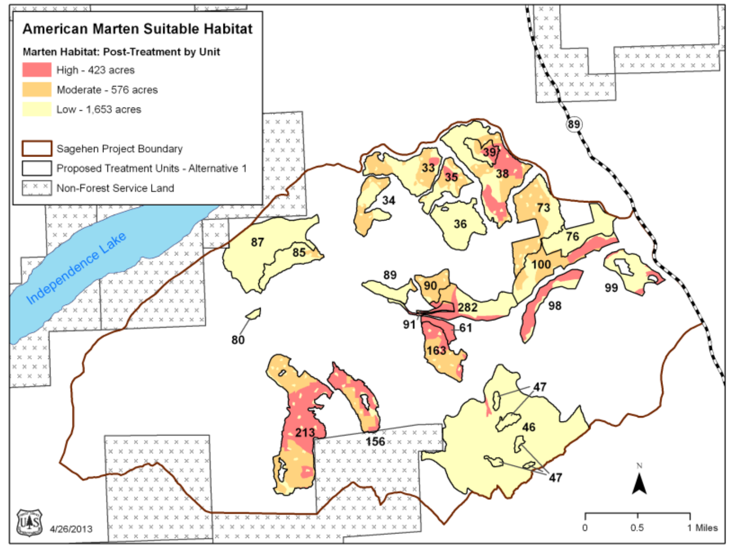

Figure 12. Marten Habitat Post-treatment by Unit

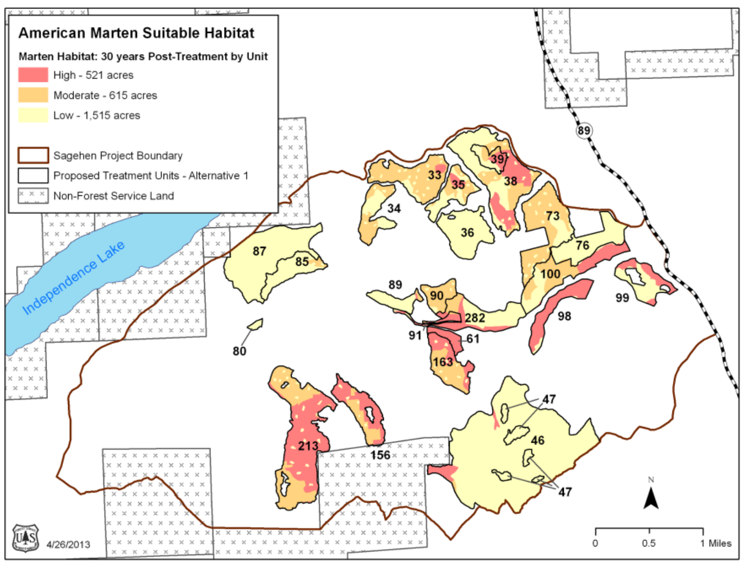

Figure 13. Marten Habitat 30 Years Post-treatment by Unit

FRAGSTAT Analysis for Marten Habitat

An analysis of marten habitat using FRAGSTATS v4: Spatial Pattern Analysis Program for Categorical and Continuous Maps (McGarigal et al. 2012) was conducted to spatially and quantitatively assess the distribution, amount and configuration of suitable marten habitat throughout the Sagehen Basin through time. This analysis addresses marten habitat in terms of patch size, patch distribution, and distance between patches.

For the analysis, existing high and moderate quality marten habitat was analyzed immediately post-treatment and 30 years post-treatment. However, there are caveats and limitations that must be considered when reviewing the results of the FRAGSTAT model. Therefore, when interpreting the results of the FRAGSTAT analysis, it is important to understand that modeling has limitations and that the results must be viewed with caution.

- FVS model have limited applicability for predicting post-treatment CWHR types, since the FVS model outputs are not spatially explicit. The average stand conditions generated from the FVS model are then used to estimate CWHR classification types. Using unknown accuracy and then running through a FRAGSTAT model further introduces uncertainty and limitations of the modeling results.

- Attempting to project vegetation changes into the future introduces uncertainty because there are not any spatially explicit growth models available. For the areas outside of units, the VDDT model was used to project vegetation 30 years beyond the present time. VDDT tool also is not a spatially explicit model. Therefore, interpretation of the VDDT vegetation changes, and then translating and applying it to a spatially explicit model, such as FRAGSTAT further introduces uncertainty.

FRAGSTAT Analysis Results:

The risk to marten habitat fragmentation was analyzed, in both in the short- and long-term, using FRAGSTAT (Version 4) (McGarigal et al. 2012) modeling (to estimate patch size, patch distribution, and distance between patches of high and moderate marten habitat within the Sagehen Basin, in a similar way that Moriarity et al. (2011) assessed marten habitat fragmentation within the Basin. A detailed description of FRAGSTAT marten habitat analysis is presented in Appendix A. Existing high and moderate quality marten habitat was analyzed immediately post-treatment and 30 years post-treatment to assess effects from treatments on potential marten habitat fragmentation. In summary, the FRAGSTAT modeling results indicate that marten habitat connectivity would be maintained following the treatments and 30 years into the future. Key results from the FRAGSTAT modeling include the following:

- High quality habitat only decreased by 0.1% across the landscape immediately post-treatment and increased to by an additional 0.5% 30 years after treatment.

- The large patches of habitat remained constant across the landscape both following treatment and 30 years into the future.
- The percentage of core area decreased from 4.12% to 3.4% initially after treatment and was predicted to increase to 4.9% 30 years after treatment.
- The distance to the nearest patch increased slightly immediately following treatment, but decreased to less than existing patch distance 30 years later. The distribution of patches changed very little. Additionally, proximity of high quality patches to one another improved both post-treatment and 30 years into the future.

Marten habitat modeling using the FRAGSTAT program is depicted in the three marten habitat maps (Figures 14, 15, 16) for existing condition, immediately post-treatment, and 30 years after treatment. Overall habitat connectivity is achieved in both the short and long-term. High quality habitat patches decreases slightly immediately post-treatment, but high quality habitat patches recovers after 30 years. Patch size, configuration and distances between patches remains consistent, except for a small portion of moderate quality habitat where canopy cover drops slightly below 40% within unit 33 for Alternative 1. None of the areas would prohibit movement or create long-term fragmentation on the landscape scale.

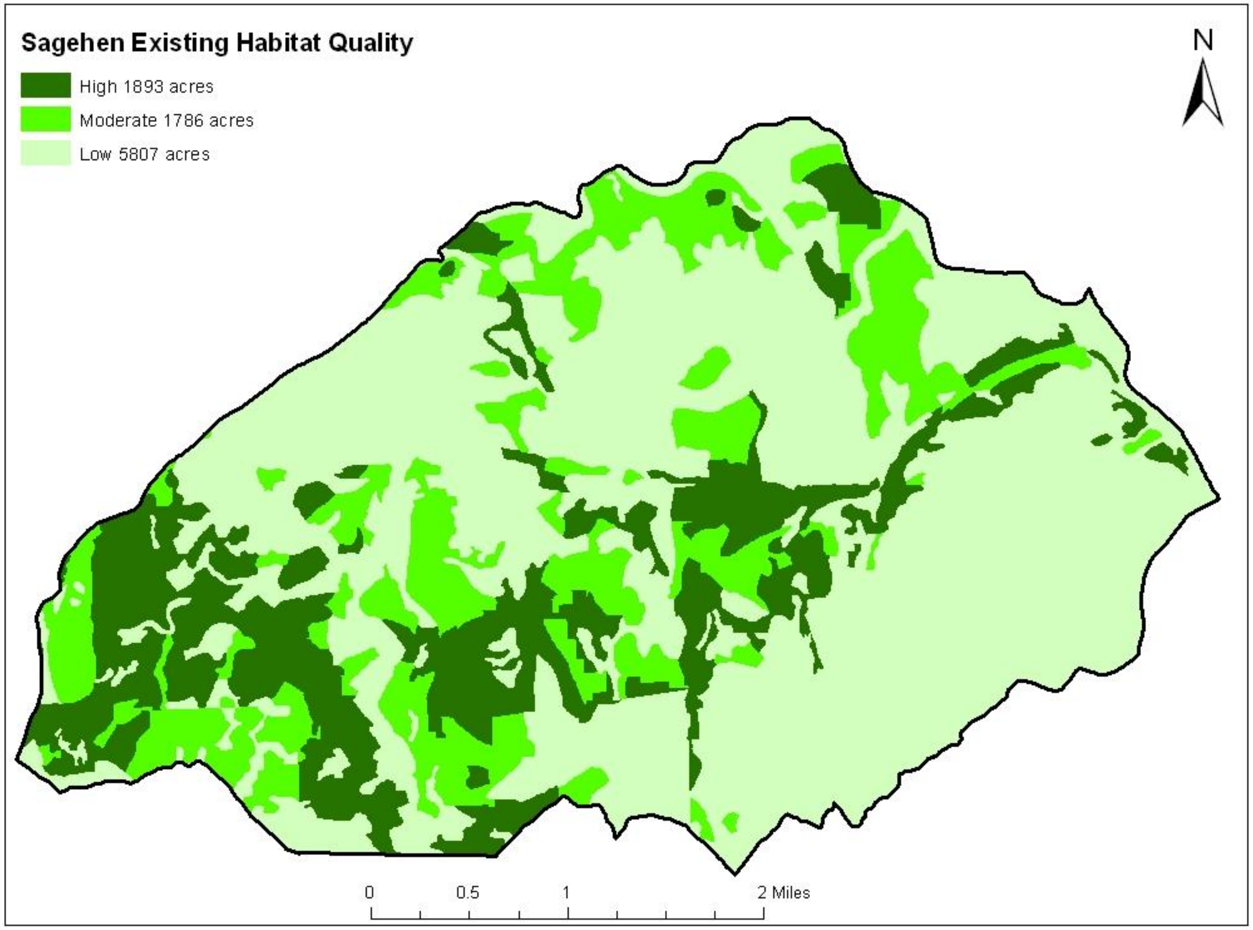

Figure 14. Existing marten habitat as classified by high, moderate, and low quality types.

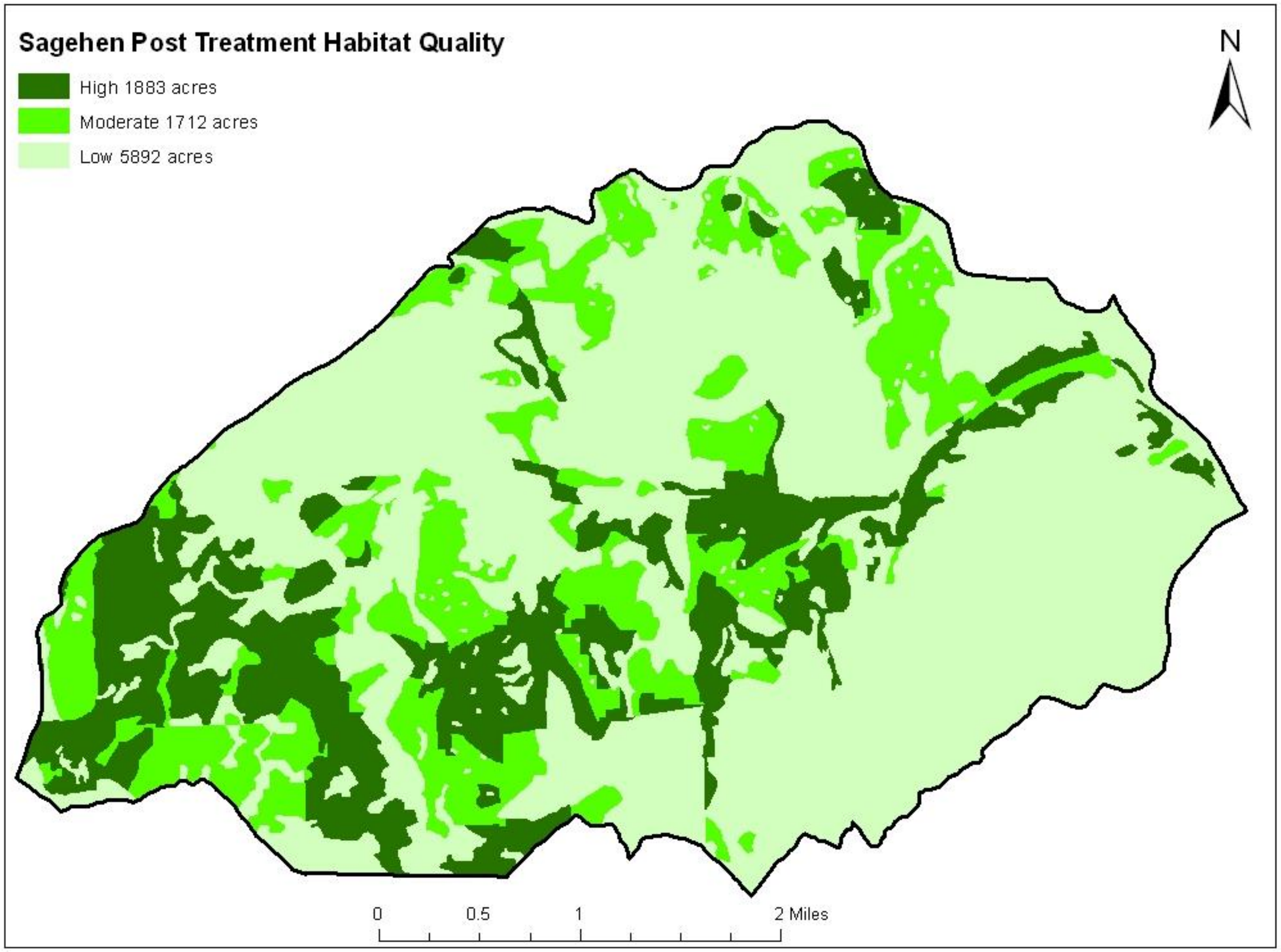

Figure 15. Post-treatment marten habitat as classified by high, moderate, and low quality types.

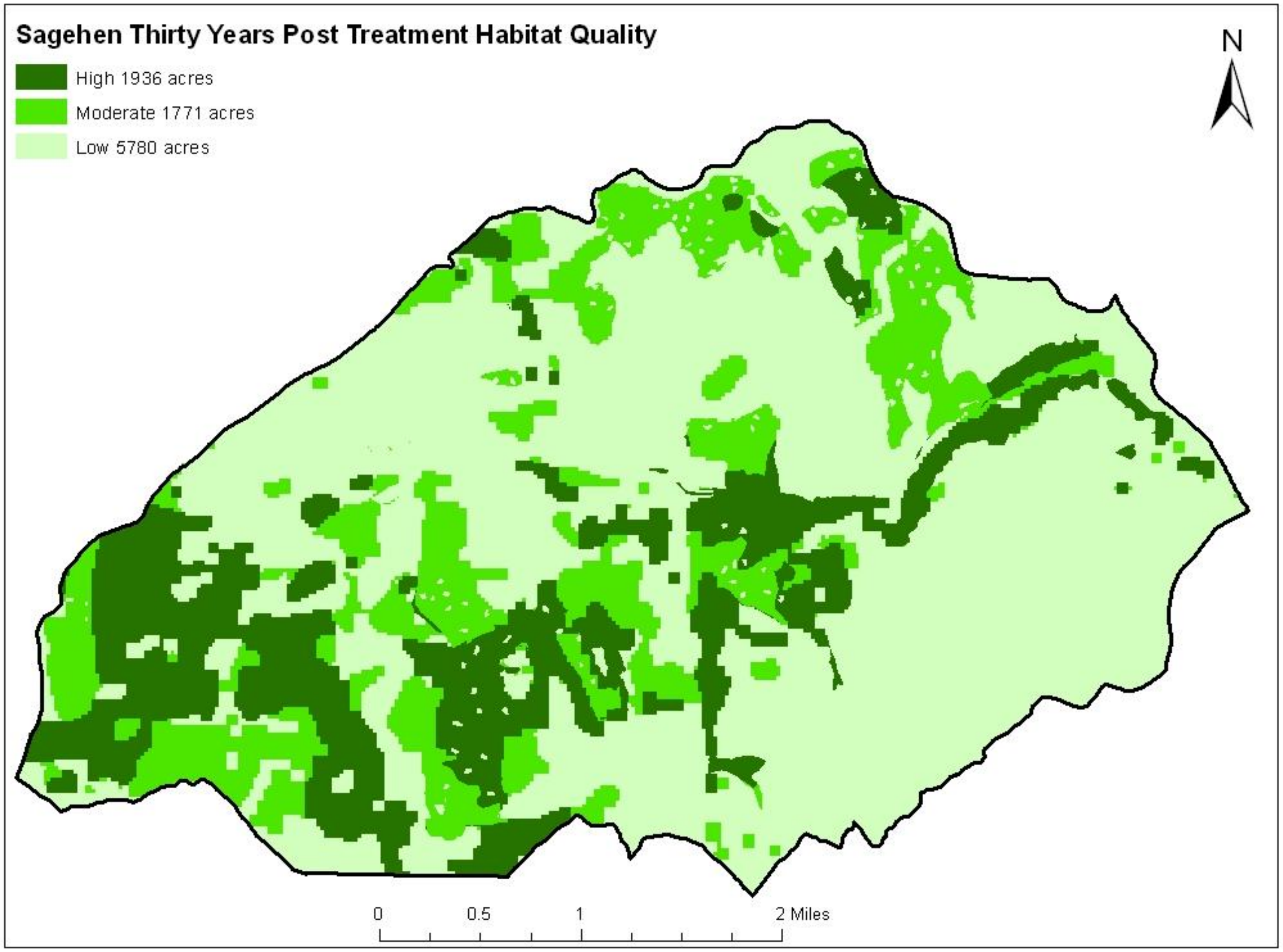

Figure 16. Thirty year post-treatment marten habitat as classified by high, moderate, and low quality type

Cumulative Effects

Past, present, and reasonably foreseeable future projects and their effects on wildlife habitat, were described in the section *Cumulative Effects Common to All Wildlife,* which also applies to the Pacific marten.

Vegetation management on both private and Forest Service lands, during the 1980s through the 1990s, resulted in extensive marten habitat modification from select tree, seed tree, and clearcut harvests. These types of treatments resulted in the removal of approximately 4,729 acres of high and moderate quality marten habitat (now in an early seral condition). Moriarity et al. 2011 suggested that marten population declines within the Sagehen Basin coincided with this period of intensive timber harvest, including the Golden Timber Sale. In addition, snag removal during broad-scale salvage operations of the 1990s occurred throughout the Basin on over 2,000 acres. Past projects (i.e. Sagehen/Spring Chicken Fuelbreaks (576 acres), Liberty/Stampede/Zingara (504 acres), and others for a total of 1,215 acres) that implemented thinning from below rendered suitable habitat quality lowered or in some cases may have been reduced in the amount of denning and foraging habitat quality in the short-term. Although many of the treatments have since recovered in canopy cover densities and tree size, the structural diversity has been simplified without multi-layered condition in many areas, and without decadent standing and down wood features. Furthermore, significant suitable nesting and foraging habitat was likely altered from wildfires including the stand-replacing 1960 Donner Ridge Fire (9,587 ac), 1960 unnamed fire (46 ac), and 1968 Sagehen Fire (152 ac), and the 1926 Independence Fire (2,653 ac).

This section will focus specifically on cumulative effects of the Sagehen Project alternatives combined with the effects of past, present and reasonably foreseeable future projects on suitable goshawk nesting and foraging habitat by changes to CWHR habitat types from treatment effects. For specific project descriptions, refer to the section on *Cumulative Effects to All Species*.

Past regeneration harvests (662 acres on Forest Service lands and an estimated 4,443 acres on private lands) resulted in long-term reductions in high and moderate quality marten denning, foraging, and resting habitat. This is supported by Moriarty et al. (2011) that showed a decrease in habitat patch size, core habitat areas, and total amount of habitat available within the Sagehen Basin. While not every acre harvested comprised this high quality habitat prior to harvest, one can assume that a substantial proportion of the harvested area would have been occupied by larger trees and had higher canopy cover levels characteristic of suitable denning habitat. While high quality marten habitat was likely removed from these regeneration harvests of the past; the amount and quantity of high and moderate quality marten habitat that was affected was likely dependent on the distribution of vegetation types within and surrounding the Basin.

Past project treatments (Sagehen/Spring Chicken fuel breaks, Liberty, Zingara, Stampede, and others) resulted in the reduction in the quality of suitable marten habitat within the analysis area. For the most part, those treatments have likely recovered in canopy cover to pre-treatment levels. However, depending on the intensity of treatments, some areas may still have very open understories, such as the fuel breaks or defensive fuel profile zones and may be lacking dead and down wood. Table 42 displays the effects to high and moderate quality marten habitat within the 29,467-acre analysis area from present and future vegetation management projects. Approximately 555 acres of suitable marten habitat (426 acres high quality habitat, 129 acres moderate quality habitat) would be reduced in quality in the short-term from present and reasonably future projects (i.e. thinning and fuels reduction), but would not result in the reduction in quantity of suitable marten habitat as shown in Table 37. The Sagehen Project would add 775 acres of suitable high and moderate quality habitat (232 acres – high quality, 544 acres - moderate quality) for Alternative 1 and 3, respectively to past cumulative effects to high and moderate quality marten habitat (Tables 35 and 36). Under Alternative 1, current unit average canopy cover ranges from 51% to 80% and post-treatment average canopy cover would range from 41% to 71%. The average unit canopy cover for Alternative 3 currently ranges from 51% to 76%. Average canopy cover for the units following treatments would range from 41% to 71% under Alternative 3.

Alternative 2, No Action, would not add to existing cumulative effects to the marten or its habitat within the analysis area. However, forest resiliency, forest heterogeneity, habitat structural diversity, snag enhancement and reduced fuels hazard would not be achieved under the No Action Alternative. Therefore, long-term threats of wildfire risk to high and moderate quality marten suitable habitat would not be reduced under Alternative 2. Potential wildfire threats under the No Action Alternative could result in increased habitat fragmentation should a stand-replacing wildlfire event were to occur within the Sagehen Basin.

Table 42. Present and Reasonably Foreseeable Future Project Effects to High and Moderate Quality Marten Habitat								
Projects	Project Acres in Analysis Area	High Quality Marten Habitat			Moderate Quality Marten Habitat			Indirect Effect
		Acres	Current CWHR Type	Post-Treatment CWHR	Acres	Current CWHR	Post-Treatment CWHR	
Billy Grunt	179.5	0	None	None	1.4	LPN4P	LPN4P	No change in habitat quantity; slight reduction in canopy cover within moderate quality habitat resulting in short-term reduction in habitat quality
Billy Mass	1648.3	5.5	LPN4D	LPN4M	2.2	SMC4D	SMC4M	No change in habitat quantity; 5 acres reduction in canopy cover within high quality habitat and 2 acres reduction in canopy cover in moderate quality
Dry Creek	194.3	0	None	None	0	None	None	No Suitable habitat, No effect to marten habitat
Independence THP	610.5	3	WFR5D	WFR5M	6	SMC4D	SMC4M	No change in habitat quantity, short-term reduction in habitat quality; 169 acres high quality and 6 acres moderate quality marten habitat will have a change in CWHR canopy class from D to M, resulting in reduced habitat quality. An additional 120 acres high quality and 93 acres of moderate quality habitat will have a reduction in canopy, but will remain within the current whr class 4M.
		165.5	(LPN, RFR, WFR) 4D	(LPN, RFR, WFR) 4M	23.8	SMC4M	SMC4M	
		15.5	WFR5M	WFR5M	68.7	(LPN, RFR) 4P	(LPN, RFR) 4P	
		104.2	(LPN, RFR, WFR) 4M	(LPN, RFR, WFR) 4M				
Outback	5.9	3.2	LPN4M	Aspen 4P	0	None	None	Short-term reduction in 3 acres high quality marten habitat, will become suitable in near-term (5-10 years)
Phoenix Project (Lira and Koruna Contracts)	562.2	42.8	WFR4D	WFR4M	0	None	None	No change in amount of suitable habitat quantity, however short-term reduction in habitat quality; 43 acres high quality habitat will have reduced canopy cover moving from D to M, with 4 acres high quality remaining in the same canopy class;
		3.6	WFR4M	WFR4M				
Transition	1038.4	66.1	WFR4D	WFR4M	13.6	EPN6D	EPN6M	No change in amount of suitable habitat, however short-term reduction in habitat quality; 66 acres high quality habitat will have reduced canopy cover moving from D to M, with 16 acres high quality remaining in the same canopy class
					7.9	JPN5M	JPN5M	
		16.2	(LPN, WFR) 4M	(LPN, WFR) 4M	3.5	MRI4M	MRI4M	
					0.9	MRI4M	Aspen4P	
					1.2	LPN4P	LPN4P	
Total	**4,239.1**	**425.6**			**129.2**			

C. Pacific Marten: Conclusion and Determination

The Sagehen Project uses concepts from GTR-220 and GTR-237 which strives to promote long-term ecosystem restoration, forest resiliency, and fuels reduction while using innovative vegetation treatments that enhances and retains suitable goshawk habitat across the analysis area. The Sagehen Project, as proposed, would:

- Maintain high and moderate quality marten habitat within throughout the treatment units in the long-term. Treatments as proposed under Alternatives 1 and 3 would result in the short-term reduction in marten habitat quality on 775 acres while promoting long-term sustainability and resiliency of habitat by treatments specifically designed to improve marten habitat such as, legacy tree treatment, fuels reduction, increased horizontal and vertical structural diversity, and decadent feature enhancements.
- Retain high and moderate quality marten habitat dominated by large trees, moderate to high canopy cover, abundance of snags and downed logs, and therefore promote marten persistence and reproductive success.
- Maintain and create habitat for marten prey species, particularly, birds and small mammals through various treatments, including dense cover areas , early seral openings, snag creation, and retention of shrubs.
- Promote forest resiliency and patch-scale heterogeneity to meet fuels and ecological restoration objectives while enhancing and maintaining marten habitat in the long-term.
- Forest management and fuels reduction strategies uses slope, topographic position and aspect that would result under a natural disturbance regime may benefit marten and its habitat, while undergoing short-term impacts.

It is my determination that implementation of Alternatives 1 and 3 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the Pacific marten within the planning area of Tahoe National Forest. In the absence of a range wide viability assessment, this viability determination is based on local knowledge of the Pacific marten as discussed previously in this evaluation, and professional judgment.

SIERRA NEVADA RED FOX

Status: USFS R5 Sensitive

A. Sierra Nevada Red Fox: Existing Environment

Genetic analysis indicates that a remnant population of the high-elevation native Sierra Nevada red fox persists in the high elevations of primarily the western half of Lassen Volcanic National Park and its surrounding area (Perrine 2005, Perrine et al. 2007). In August, 2010, a handful of foxes were discovered by motion sensitive cameras near Sonora Pass set up to detect marten and fisher. These Sierra Nevada red foxes were photographed in the central Sierra Nevada more than 200 miles away from Lassen Peak and genetic analysis was compared to museum specimens from prior to 1926, confirming their identity. They had not been seen in the Sonora Pass area since 1925.

Outside of these two areas, recent surveys in the forests of the southern Cascade Range and throughout the Sierra Nevada have not detected Sierra Nevada red fox, and they may be extirpated or in extremely low densities in the areas surveyed (Zielinski et al. 2005). Other multiple low-elevation red fox populations in California are thought to be of exotic origin (Perrine et al. 2007). Perrine et al. (2007) support the use of a 3,500 feet elevational boundary that successfully separates high-elevation from lowland populations for management purposes.

Perrine (2005) found that the Lassen population was restricted to the highest elevations, with the lowest elevation at which camera stations detected red fox of 4,524 feet, and that on average, summer telemetry locations were 1,572 feet higher in elevation that winter locations, suggesting descent to lower elevations during the winter and return to higher elevations for the summer. Records summarized by Schempf and White (1977) suggested that Sierra Nevada red fox occurred mainly at elevations greater than 7,000 feet, and seldom below 5,000 feet throughout its range; in the northern Sierra Nevada most records occurred between 5,400 and 7,400 feet.

Perrine (2005) found large seasonal home ranges, with a mean of 6,336 acres in summer and 8,043 acres in winter.

Schempf and White (1977) summarized published literature and records of the Sierra Nevada red fox, which suggested the species was found in red fir, lodgepole, and sub-alpine forests, and in alpine talus, and hunted in open areas, such as above timberline, open grassy parks and meadows, and open forest stands. Schempf and White (1977) found that in the northern Sierra Nevada, most records occurred in fir and mixed conifer types, with a large number of sightings also in pine and lodgepole. In the southern Sierra, most sightings were in mixed conifer forests, although lodgepole pine and fir were also important (Schempf and White 1977). Red fox may be more tolerant of openings than either marten or fisher, as they will hunt in open areas. Predator avoidance in the open may not be a problem for this native fox (Duncan Furbearer Interagency Working Group 1989). Perrine (2005) found that the presence of mature closed-canopy forest was a significant predictor of red fox occurrence in winter, but not in summer when red foxes move to higher elevations. Snow tracking of red foxes in the Lassen area, though their sample was very small (2 individuals, 9 tracks amounting to 11.7 miles), suggested preferential use of forests with >40% canopy cover during winter over more open or shrub communities; when tracks approached more open areas, they generally altered course and followed the forested edge (Benson et al. 2005).

Perrine (2005) found that red fox were detected at fewer camera stations, within fewer habitat types, and across a smaller area than either coyotes or martens in his study. Perrine (2005) found that red fox detections were disproportionately abundant at cameras in high elevation conifer community types and were under-represented at cameras in mid-elevation conifer communities, and tended to be detected at cameras in barren areas such as talus slopes (Perrine 2005). Red fox association with shrub communities depended on elevation and the scale of the analysis; detections appeared disproportionately abundant at cameras in montane chaparral, but none occurred in lower elevation sagebrush (Perrine 2005). Modeling conducted by Perrine (2005) on detections in the Lassen area suggested that red fox detections in summer were positively correlated with elevation, highway density, and with detections of coyotes, and negatively correlated with shrub and herbaceous cover; in winter, detections were positively correlated with elevation, highway density, and mature closed-canopy forest cover.

Opportunistic hunters, their diet is omnivorous over most of the year, but meat is the most prevalent food in winter (Schempf and White 1977). Perrine (2005) found that their diet was predominantly mammals, especially rodents and mule deer, supplemented by birds, insects, and manzanita berries as seasonally available; lagomorphs were virtually absent from their diet and may have been due to their lack of availability in the area, as they were also absent from the coyote and marten diet in the study area. Mule deer was likely scavenged as carrion (Perrine 2005).

Although no specific criteria for analyzing red fox habitat has been developed and little is known about this species, it is assumed that red fox may be more adaptable than other furbearers. Further, it is assumed that if the more restrictive habitat requirements of fisher, marten, willow flycatcher, and California spotted owls are provided, the habitat requirements will be met for red fox (Freel 1991).

Sierra Nevada red fox has not been detected on the Tahoe NF in spite of substantial surveys across the Tahoe NF. Only two populations of Sierra Nevada red fox are known within the Sierra Nevada Bioregion – one near Mt. Lassen and one on Sonora Pass. The Sagehen Project is located at or below the lower elevational range (7,000 ft.) where Sierran red fox populations are generally found.

B. Sierra Nevada Red Fox: Effects of the Proposed Action and Alternatives including Project Design Standards

Since, the Tahoe NF and the Sagehen Project are outside the geographic range of currently known Sierra Nevada red fox populations, the Sagehen Project will not affect this species, and will not be analyzed further.

C. Sierra Nevada Red Fox: Conclusion and Determination

It is my determination that implementation of Alternatives 1 and 3 will not affect the Sierra Nevada red fox.

CALIFORNIA WOLVERINE

Status: USFS R5 Sensitive

A. California Wolverine: Existing Environment

The wolverine is a California State Threatened species, and is listed on the USFS Regional Forester's Sensitive Species list. The wolverine has been petitioned for listing as threatened or endangered under the Endangered Species Act, but upon status review in 2008 the USFWS determined it was not warranted listing (USDI Fish and Wildlife Service 2008; 73 FR 12929). On July 8, 2008 FWS received a Notice of Intent to Sue from Earthjustice alleging violations of the Act in their March 11, 2008, 12-month finding. On September 30, 2008, Earthjustice filed a complaint in the U.S. District Court, District of Montana, seeking to set aside and remand the 12-month finding back to the Service for reconsideration.

On March 6, 2009, the Service agreed to settle the case with Earthjustice by voluntarily remanding the 12-month finding and issuing a new 12-month finding by December 1, 2010. Following the settlement agreement, the court dismissed the case on June 15, 2009, and ordered the Service to comply with the settlement agreement.

On April 15, 2010, the Service published a Notice of Initiation of a 12-month finding for wolverines in the contiguous United States (75 FR 19591). That finding was published on December 14, 2010, and determined that the wolverine in the contiguous United States constituted a Distinct Population Segment and that the DPS warranted listing under the Act, but that listing was precluded by higher priority listing actions (75 FR 78030).

On September 9, 2011, the Service reached an agreement with plaintiffs in *Endangered Species Act Section 4 Deadline Litig.,* Misc. Action No. 10-377 (EGS), MDL Docket No. 2165 (D. D.C.) (known as the "MDL case") on a schedule to publish proposed rules or to withdraw warranted findings for the species on the list of candidate species. This agreement stipulated that the Service would submit for publication in the **Federal Register** a proposed listing rule for the wolverine, or withdraw the warranted 12-month finding, no later than the end of the 2013 Fiscal Year.

On April 13, 2012, several parties filed an action challenging the Service's December 14, 2010 warranted but precluded finding for wolverine. *Cottonwood Envtl. Law Ctr., et al. v. Salazar, et al.,* 9:12-cv-00057-DLC (D. Mont.) On September 20, 2012, the court granted the Service's motion to stay that litigation based on the Service's representation to the Court that it expected to submit this rule or withdraw the warranted finding to the **Federal Register** by January 18, 2013.

On February 4, 2013, The U.S. Fish and Wildlife Service published a proposed rule to list the distinct population segment of the North American wolverine occurring in the contiguous United States, as a threatened species under the Endangered Species Act (USDI Fish and Wildlife Service 2013; [FWS–R6–ES–2012–0107: 4500030113]. FWS also proposes a special rule under section 4(d) of the Act to apply the specific prohibitions of the Act necessary to protect the wolverine. The FWS has determined that habitat loss due to increasing temperatures and reduced late spring snowpack due to climate change is likely to have a significant negative population-level impact on wolverine populations in the contiguous United States. In the future, wolverine habitat is likely to be reduced to the point that the wolverine in the contiguous United States is in danger of extinction.

The wolverine occurs at low densities and is secretive, difficult to observe even in core areas of its range, and one of the rarest and least known mammals in North America (Aubry et al. 2007). Zielinski et al. (2005), based on the lack of detections of wolverine in contemporary surveys, noted that the California wolverine may be extirpated or in extremely low densities from the southern Cascades through the Sierra Nevada. Since the last historic specimen was collected in California in 1922 (Fry 1923, and Grinnell et al. 1937 as cited in Aubry et al. 2007), there have been periodic anecdotal sightings (lacking conclusive physical evidence) of the wolverine in California including many in Tahoe National Forest, though these anecdotal sightings should be interpreted with caution (refer to McKelvey et al. 2008). In 2008, photographs and DNA were collected which verified the presence of a single male wolverine on the east side of Tahoe National Forest (Moriarty et al. 2009). Genetic analysis of this individual compared with wolverines across their range, including the seven genetic samples from California wolverine museum specimens (Schwartz et al. 2007), supports that the origin of this individual is from the western edge of the Rocky Mountains region, possibly from the Sawtooth Mountain Range in Idaho (Moriarty et al. 2009). Additional photographs of this individual (confirmed with DNA analysis) have been collected since that time on land owned by Sierra Pacific Industries (SPI) in the checkerboard ownership area in the northern portion of Tahoe National Forest (SPI, unpublished data on file at Tahoe National Forest, Supervisor's Office).

The historic geographical range of the wolverine in California was originally described from the vicinity of Mount Shasta to Monache Meadows in Tulare County (Grinnell 1913 as cited in Shempf and White 1977), which was later refined to Lake Tahoe through Tulare County in the central and southern Sierra Nevada (Grinnell 1933 and Grinnell et al. 1937, as cited in Shempf and White 1977). Fry (1923) noted that the wolverine was found in the high Sierra between 6,500 and 13,000 feet, that it was becoming very rare with individuals few and scattered where still found, and were most abundant in the vicinity of Mt. Whitney and Sequoia National Park. Grinnell et al. (1937) noted that "the wolverine in California is found chiefly in the Boreal life zone...at the time of heavy snowstorms in midwinter, wolverines have been found as low as 5,000 feet on the westslope of the Sierra Nevada...But ordinarily the wolverine is not known to come below 8,000 feet, even in the severest storms of winter." Grinnell et al. (1937) estimated that there were no more than 15 pairs of wolverines left in California in the early 1930s. Based on reported sightings from various sources, Schempf and White (1977) described the wolverine distribution in California as a broad arc from Del Norte and Trinity counties (Yocum 1973) east through Siskiyou and Shasta Counties (Wildlife Management Institute 1974 as cited in Schempf and White 1977), and south through the Sierra Nevada to Tulare County (Jones 1950 and 1955). Kovach (1981) expanded this range to include the White Mountains in Mono County. Shempf and White (1977) described the elevational range in the North Coast mountains from 1,600 to 4,800 ft, in the northern Sierra Nevada from 4,300 to 7,300 ft, and in the southern Sierra Nevada from 6,400 to 10,800 ft. However, Aubry et al. (2007) scrutinized the historical records, and suggest that historically the wolverine population in the Pacific states was disjunct, with a large gap in distribution from the populations in the north Cascades and the Rocky Mountains to the historic California wolverine population, which only occurred in the central and southern Sierra Nevada. This conclusion is reinforced by genetic analysis conducted by Schwartz et al. (2007). Schwartz et al. (2007) compared DNA from seven historical specimens of wolverines from California with those from other locations throughout their holarctic distribution; their results indicate that wolverines from California likely genetically diverged over 2,000 years (and possibly much longer) ago from any other population, and are genetically more similar to Eurasian wolverines than to other North American populations.

Wolverine habitat relationships, particularly in the contiguous lower 48 States, are not well-studied (Ruggiero et al. 2007, Aubry et al. 2007, Copeland et al. 2007). Empirical data from peer-reviewed literature on habitat relations, home-range sizes, or behavior exist from only two areas in the contiguous lower 48 States, one study area in northwestern Montana (Hornocker and Hash 1981) and one study area in central Idaho (Copeland 1996, Magoun and Copeland 1998, Copeland et al. 2007); population-level demographic analysis has recently been conducted in three other study areas of the lower 48 States (Squires et al. 2007), primarily in western Montana and overlapping into the Idaho panhandle. Other studies have been conducted in Alaska (e.g. Magoun and Copeland 1998, Dalerum et al. 2007, Golden et al. 2007), Canada (eg. Rowland et al. 2003, Krebs et al. 2007, Lofroth et al. 2007, Mulders et al. 2007) and other parts of their holarctic range (e.g. Pulliainen 1968, Sæther et al. 2005, May et al. 2006, Persson et al. 2006, Hedmark et al. 2007). Literature reviews, some with analysis of natural history attributes and recommendations for management, have also been conducted (e.g. Shempf and White 1977, White and Barrett 1979, Butts 1992, Copeland and Kucera 1997). Shempf and White (1977) used reported observations of wolverines in California to characterize habitat types and elevational ranges.

In their analysis of broad-scale habitat relations, Aubry et al. (2007) found the only habitat characteristic that fully accounted for the historical distribution (refined to only verifiable and documented records which could be mapped with some degree of precision and excluding anecdotal observations) was persistent spring snow cover through the denning period (mid-April to mid-May), and generally associated with alpine vegetation and alpine climatic conditions. Aubry et al. (2007) speculated that if the persistence of wolverine populations is linked to the availability and quality of relatively deep snow for reproductive den sites (refer to Magoun and Copeland 1998) insufficient snow cover during the denning period could play an important role in limiting their distribution.

Magoun and Copeland (1998), though their sample sizes were relatively small, found that natal dens (parturition sites) in Alaska (n = 6) were located in deep snowdrifts along minor drainages with complex and long (average >30 m) subnivean tunnel systems, and in Idaho (n = 2) were located in subnivean chambers and branching passageways in snow-covered boulder talus in subalpine cirque basins in openings <100 m wide and surrounded by trees on north-facing slopes (Magoun and Copeland 1998). In both Alaska and Idaho, abandonment of natal dens coincided with the period when maximum daily temperatures rose above freezing for a number of days since denning commenced, corresponding with change in the snowpack (Magoun and Copeland 1998). Magoun and Copeland (1998) found that maternal dens (used post-parturition to weaning) in Idaho were usually snow tunnels leading to naturally formed chambers beneath either large boulders or fallen trees and usually at somewhat lower elevations (maximum decrease 984 feet) than the natal dens. In Finland, Pulliainen (1968, as cited in White and Barrett 1979) described 31 dens, also finding that most of them were under deep snow. Fry (1923) described two wolverine natal dens, as “was plainly evidenced by the premises and surroundings”, which were found around 11,000 feet elevation in Sequoia National Park as “under shelving rocks”. While frequent visits by researchers to a natal den in Alaska did not cause den abandonment, once the kits are moved to a maternal den, females in Alaska and Idaho have been found to abandon the maternal den soon after researchers visited the area, on one occasion within an hour, with the female moving the kits to a different maternal den (Magoun and Copeland 1998).

Little is known regarding wolverine use in forested habitats. Wolverines have a close association with large ungulate mammals, such as deer. However, habitats managed for deer may not necessarily provide for the wolverine’s other life history needs. The low availability of natal dens may limit reproduction in some areas, and physical structure such as coarse woody debris may be important. According to Banci (1994), management prescriptions that successfully provide for the life needs of species such as the Pacific marten, fisher, lynx and their prey will also provide for the needs of wolverine at the stand level. It is not known whether this will provide for wolverine habitat needs at the landscape or larger scales. At the landscape level, the wolverine’s large home ranges need to be considered in forest management planning (Banci 1994). However, what is understood about home range size and habitat use is generally from remote, undeveloped northern regions and generally is not known for the Sierra Nevada. Schempf and White (1977) extrapolated from locations of anecdotal reports of wolverines in the northern Sierra Nevada that they use mixed conifer habitat (8 of 16 reports), lodgepole (4 of 16 reports), and fir (3 of 16 reports). White and Barrett (1979) believed that wolverines in California are highly dependent upon mature conifer forests for survival in winter, and generally move downslope in winter into heavier timber where food is available. In their preliminary search for study animals previous to capture for their demographic analysis, Squires et al. (2007) considered all forested areas (excluding ponderosa pine forest) and areas above tree line as potential wolverine habitat.

In central Idaho, Copeland et al. (2007) examined habitat associations by aerial and ground radio-tracking, finding that elevation was the strongest and most consistent explanatory variable across all of their logistic regression models. Excluding mountaintops, wolverines favored higher elevations; 83% of all wolverine use points occurred in a relatively narrow elevation band from approximately 7,200 to 8,500 feet elevation, and there was only a minor but statistically significant seasonal shift downward in elevation (mean of 325 feet) during winter except for adult females which did not exhibit a significant downward shift (Copeland et al. 2007). In the central Idaho study area, alpine scree habitats associated with talus and open mountaintops above timberline generally occurred above approximately 8,850 feet elevation; modeling indicated that these habitats were used but not beyond availability in summer, and were avoided in winter (Copeland et al. 2007). In northwestern Montana, Hornocker and Hash (1981) also found a seasonal trend in elevational use; with mean elevation in winter (4500 feet) lower than those in spring (5500 feet), summer (6300 feet), and fall (6,200 feet). In central Idaho, Copeland et al. (2007) found that northerly aspects were generally preferred in both seasons (except for adult males in the summer), possibly related to the increased prevalence of the shrub-grass vegetation type (which the wolverines strongly avoided) on southerly aspects. In contrast, in northwestern Montana Hornocker and Hash (1981) found that while all aspects were used, the easterly and southerly aspects received the majority of consistent use. In the northwestern Montana study area, Hornocker and Hash (1981) found that various types of topography were used; slopes were used 36%, basins 22%, wide river bottoms 14%, and ridge tops 8%. In central Idaho, Copeland et al. (2007) found in their models that steep slopes were a strong variable for wolverine presence in summer, most notably in adults, but noted that this may have been reflective of the preference for the higher elevations in which the steeper slopes occur with more frequency.

Hornocker and Hash (1981) found that large areas of medium or scattered mature timber accounted for 70% of all relocations, and areas of dense young timber were used least. Hornocker and Hash (1981) noted that wolverines were found in wet timber, dry timber, and alpine areas during 23%, 31%, and 16% of their relocations, respectively, and were rarely found in burned or wet meadow areas. Hornocker and Hash (1981) found that wolverines appeared reluctant to cross openings of any size such as recent clear-cuts or burns; they state: “Tracking revealed that wolverines meandered through timber types, hunting and investigating, but made straight-line movements across large openings.” They note that edge and ecotonal areas are used (Hornocker and Hash 1981). Averaged across seasons, wolverines were located in alpine fir, alpine fir-spruce, and alpine fir-lodgepole pine cover types 56% of the time, and also in Douglas fir-lodgepole pine (22%) and Douglas fir-larch (17%) (Hornocker and Hash 1981). Copeland et al. (2007) found that use of vegetation communities varied by season but the variation was relatively minor, rock-barren habitats which generally occurred at the highest elevations were generally used at proportions less than their availability except by adult males during summer, and grass-shrub habitat was avoided (Copeland et al. 2007). Modeling of habitat use by Copeland et al. (2007) suggested that in summer, adult females and subadults were associated with whitebark pine, and adult males were associated with rock-barren habitat; in winter, adult females were associated with douglas fir-lodgepole, subadults were associated with douglas fir, and adult males were associated with lodgepole pine. Non-use of Douglas fir-ponderosa pine was consistently indicated in their models, primarily during summer, but it was not strongly significant (Copeland et al. 2007). They noted that lodgepole pine tended to dominate the lower fringes of the subalpine zone and that adult males tended to travel more widely than females, and as such were more likely found in lower, conifer-dominated habitats simply by chance; montane conifer forest accounted for 70% of adult male locations. Copeland et al. (2007) stated: “We think is reasonable to assume that the wolverine’s association with particular vegetation types had less to do with the vegetative species than with some other ecological component provided by or associated with a particular habitat. We speculate, as have others, that seasonal variation in habitat use is a response to varying food availability.”

Copeland et al. (2007) state: “The wolverine has long been considered sensitive to human presence based largely on the species’ contemporary presence within remote, isolated areas. Several empirical studies have also come to the same conclusion, reporting spatial separation of wolverine and human-related infrastructure (Carroll et al. 2001, Rowland et al. 2003, May et al. 2006), but it is still unclear whether this is truly a cause-effect relationship or simply a description of the species’ tendency to reside in areas that are generally inhospitable to human development.” Through modeling of occurrence data in the Rocky Mountains, Carroll et al. (2001) found a negative relationship of wolverine occurrence with road density >2.7 mi/mi^2. Landscape modeling conducted by Rowland et al. (2003) indicated that at the larger sub-basin scale, an overlay of amount of habitat and road-density class was the best predictor of wolverine occurrence, however, amount of habitat alone was nearly as good a predictor; at the watershed scale road density and human population density were better than amount of habitat or habitat class. In Norway, May et al. (2006) found that wolverines exhibit more habitat selectivity in undeveloped habitats than in developed habitats. Copeland et al. (2007) found no apparent association between wolverine presence and trails, either reflecting a lack of sensitivity to human presence or a low frequency of human presence on the trails; they noted it was not uncommon to find study animals near trails and active campgrounds in summer (Copeland et al. 2007). Their distance-to-road statistics indicated nonuse of areas near roads, but most roads in their study area were located at lower elevations on the periphery of the study area, so meaningful interpretation of these results could not be gleaned in light of the preference for high elevations; they noted, however, that in winter, unmaintained roads used by the researchers for snowmobile access were frequently used for travel by wolverines (Copeland et al. 2007). In northwestern Montana, Hornocker and Hash (1981) found no difference in wolverine density, movement, habitat use, or behavior between the wilderness and non-wilderness portions of their study area; they point out, however, that that the whole area is bordered by rugged relatively inaccessible mountains, and in winter the non-wilderness portion is snowbound and human activity is practically nonexistent; it is used by humans primarily for logging and recreation in summer, when wolverines tend to occupy the higher elevations (Hornocker and Hash 1981). Hornocker and Hash (1981) also state: "Movements of wolverines in Montana are not apparently affected by rivers, reservoirs, highways, valleys, or major mountain ranges." In the Columbia Mountains of British Columbia where winter recreation is widespread, Krebs et al. (2007) found that female wolverines were negatively associated with helicopter skiing and backcountry skiing.

Wolverines have large spatial requirements; the availability and distribution of food may be the primary factor in determining wolverine movements and home range (Hornocker and Hash 1981, Banci 1994). Individuals may move great distances on a daily basis; in northwestern Montana Hornocker and Hash (1981) found that the maximum distance traveled in 3 days was roughly 40 miles for males, and 24 miles for females. In central Idaho, Copeland et al. (2007) noted that wolverines were capable of crossing their home range in 24 hours. Except for females providing for offspring, or males seeking mates, movement is generally motivated by food (Ruggiero et al. 1994). During summer, long distance movements appear to be restricted to night when temperatures are cooler (Hornocker and Hash 1981). Home ranges of wolverines are generally extremely large and vary greatly depending on gender, availability of food, age, and differences in habitat. In northwestern Montana, Hornocker and Hash (1981) calculated the average annual range of males and females as 163 mi^2 and 150 mi^2, respectively. In central Idaho, Copeland (1996) found that the annual home ranges of resident adult males and females averaged 588 mi^2 and 148 mi^2, respectively. In the Columbia Mountains of southeastern British Columbia, Krebs et al. (2007) calculated the average annual range of males and females as 298 mi^2 and 126 mi^2, respectively, and in the Omineca Mountains of northcentral British Columbia 527 mi^2 and 156 mi^2, respectively. Hornocker and Hash (1981) noted that two lactating females exhibited very similar, greatly reduced spring and summer ranges of approximately 39 mi^2 each. They also stated: "Wolverines exhibited fidelity to a given area, but several individuals of both sexes made frequent long movements to other areas. The length of time spent away from the apparent home area varied from a few days to as long as 30 days. In all instances wolverines returned to the same area." Hornocker and Hash (1981) found that home areas overlapped between individuals of the same and opposite sex, with scent marking maintaining space between individuals in time but not in area. They indicate, however, that mortality (in this trapped population) may have been high enough to keep territorialism from becoming established (Hornocker and Hash 1981).

Wolverines are generally described as opportunistic omnivores in summer and primarily scavengers in winter (Fry 1923, Ruggiero et al. 1994). Copeland et al. (2007) suspected that the minor seasonal variation in habitat use they observed was likely more related to varying food availability than to association with particular vegetation types. Wolverines primarily scavenge carrion in winter, but also prey on small animals and birds, and in summer may eat fruits, berries, and insects (Banci 1994). In two separate study areas in British Columbia, Lofroth et al. (2007) found that wolverine diet varied regionally and seasonally, with regional differences related to difference in prey availability between study areas. Lofroth et al. (2007) also found that in the winter season, diet by reproductive females were different than other sex and age classes. Hornocker and Hash (1981), based on scat analysis, found that carrion appeared to be a mainstay in their winter diet and believe wolverines take a wide variety of food in spring and summer when it is more available; in summer they were unable to attract wolverines to large freshly killed carcasses. Wolverines have an excellent sense of smell, enabling them to find food beneath deep snow (Hornocker and Hash 1981). Hornocker and Hash (1981) noted that backtracking revealed that different individuals came directly to their bait stations from distances exceeding 2 miles, presumably initially detecting the bait by scent. In central Idaho, Copeland et al. (2007) found that wolverines displayed no affinity for ungulate (elk in their study) winter range, and that carrion use in winter occurred generally in mid-elevation forest and in many cases was it was associated with hunter wounding mortality, with the hunting season in fall. In the southern Sierra Nevada, Fry (1923) listed the principal foods as “yellow-bellied marmots, carrion, gophers, rats and mice, with occasional sick or crippled wild animals which he is able to drag down”. In northwestern Montana, Hornocker and Hash (1981) found no evidence of wolverines either preying on or attempting to prey on game species, but found they did kill smaller prey such as marmot, snowshoe hares, and rodents; snow-tracking revealed that they hunted brush piles, log jams, heavy cover, and tree wells. Hornocker and Hash (1981) noted that marmots, dug from hibernation dens, were found in 11% of the winter scats. In British Columbia, Krebs et al. (2007) found that male habitat associations were most supported by food-related variables in both summer and winter (moose winter range), and in summer females were associated with alpine and avalanche environments where hoary marmot and Columbia ground squirrel prey are found, while in winter they were associated with moose winter range. Female habitat associations were complex and appeared to be influenced by several factors including food, predation risk, or human disturbance (Krebs et al. 2007). During the summer, marmots, ground squirrels, gophers, mice, berries, insects, and even porcupines may be taken while foraging in open to sparse tree habitats on the ground, in trees, burrows, among rocks, and sometimes in shallow water (Zeiner et al. 1990, Ruggiero et al. 1994).

In 1977-78, a study conducted by the California Department of Fish and Game did not detect any wolverines in the north Sierras (Hummel 1978). During the winter of 1991-92, the California Deptartment of Fish and Game, University of California Berkeley, and five National Forests conducted a cooperative wolverine study using baited infra-red camera systems at 57 camera stations. Forests involved were the Inyo, Lake Tahoe Basin Management Unit, Shasta-Trinity, Stanislaus, and Tahoe National Forest. No wolverines were detected. During this study, fifteen of the camera units were placed within Tahoe National Forest for various lengths of time. In 1993 and 1994, Tahoe National Forest conducted additional studies using five camera units that were monitored by volunteers. No wolverines were detected. During the winters of 1998 through 2004, 136 baited camera survey stations were conducted primarily on the Sierraville Ranger District to USFS Region 5 protocol (Zielinski and Kucera 1995). Wolverines were not detected during these survey efforts.

Anecdotal sightings of wolverines have been reported in Tahoe National Forest. Ruth (1954) reported a wolverine in Squaw Valley during an Audubon Camp field trip which was observed by about 25 people. Schempf and White (1977) reported three recorded sightings in the Webber Lake area on Sierraville Ranger District, and on Truckee Ranger District near Martis Creek, though these may have been marmots. On Sierraville Ranger District, a wolverine sighting of unknown reliability is recorded near Jackson Meadows Reservoir in 1971, other incidental reports of unknown reliability have come from the public near Webber Lake Falls. More recent incidental sightings that could potentially be wolverine include a 1991 sighting reported in Euer Valley on Truckee Ranger District. A 1992 sighting in the Harding Point area, northeast of Sierraville, was confirmed by track identification. Sightings on the Yuba River Ranger District include one in 1989 in the Haskell Peak area, one in 1990 in the Upper Sardine Lake area, one in 1993 along the Gold Lake Road and Salmon Lake Road area, one in 1998 near Bassett's Station, and one at Sawmill Lake (near Bowman Lake) in 2008. Close to the Tahoe National Forest boundary with Plumas National Forest, sightings have been reported in the Gold Lakes Basin; one around 2006 and one in July 2009. On the Foresthill Ranger District, a wolverine was sighted in the Robinson Flat area in 1980 by a wildlife biologist, in 1992 a wildlife biologist observed a wolverine in the Granite Chief Wilderness Area, and around 2003 a wildlife biologist observed a wolverine near Foresthill.

In 2008, following the confirmed detection of the male wolverine in Tahoe National Forest (discussed in Moriarty et al. 2009), numerous sightings were called in to Tahoe National Forest personnel which vary in date as far back as 1965. These reports include one from Prosser Dam on Truckee Ranger District in August 1965, a report of a dead wolverine found along the Gold Lake Highway in 1972, one from Sawmill Lake in August 1997, one from Bowman Lake Road near Henness Pass in 2000, one in the Webber Lake Falls area in summer 2004, one at Sierra Ski Park in January 2008, and one with unknown year from The Cedars area.

The single male wolverine that was detected in the Sagehen Basin during a research study by Katie Moriarity in 2008 has been detected on the Tahoe NF on a regular basis during the last five years by agency biologists, biologists from the Sierra Pacific Industry on private lands, and public members within the boundary of the Tahoe NF. Genetic information indicates the wolverine appears to be the same lone male individual, and was most recently photographed by a hiker during the spring of 2012 in the Grouse Lakes area. This individual wolverine has been detected over the last several years across approximately a 300-square mile area.

B. California Wolverine: Effects of the Proposed Action and Alternatives including Project Design Standards

Direct Effects: Direct effects to wolverine from disturbance is been speculated to occur from human activities including winter and summer recreation, housing and industrial development, road corridors, and timber harvest or mining. The Sagehen Project has the potential to directly disturb the wolverine if it were to be in the vicinity of treatment units. However, since the wolverine has a very large home range (~300 sq. mi.), there is a low potential that project treatments would actually coincide with the occurrence of wolverine, since the Saghen Project encompasses less than 3,000 acres and the home range for the wolverine ranges across the Tahoe NF Forest. The Sagehen Project would equate to less than 2 percent of the wolverine's home range. Moreover, the wolverine would likely occupy higher elevation areas (above 8,000 feet) during the summer or fall months when project implementation would take place. However, there is a potential that direct effects from project activities could occur. In addition, since the individual is a single, lone male, it has not been established that there is a natal den site on the Tahoe NF or in the project vicinity. Therefore, natal den sites would not likely be affected by project activities proposed under the action alternatives.

Alternative 1 would have the greatest potential of direct effects to the wolverine, since more than twice the area would be disturbed compared to Alternative 3; and the use of mechanical methods would have greater disturbance potential from noise and felling of large trees. Alternative 3 would disturb wolverine to a lesser extent particularly since the treatments are all hand treatments, with a minor amount of mastication. Alternative 2 would not directly affect the wolverine as no treatments are proposed.

Indirect Effects: Few effects to wolverines from land management actions such as grazing, timber harvest, and prescribed fire have been documented (USDI Fish and Wildlife Service 2013). Proposed forest thinnings and fuels treatments under Alternatives 1 and 3 have the potential to modify wolverine habitat. However, the habitat relationship between wolverines and forest conditions is not well-understood. Wolverines are not considered to be dependent on specific vegetation or habitat features, and there is no evidence that would suggest that land management activities, including forest thinning and fuels reduction are a threat to the conservation of the species. Wolverine habitat fragmentation and decrease is attributed to future climate change. The best available science indicates that other potential stressors, such as land management, infrastructure development, and transportation corridors do not pose a threat to the conservation of the species.

Since, wolverine occupy large home ranges with a variety of habitat conditions, including sparsely vegetated alpine areas to densely forested areas, there is no clear relationship of wolverine habitat requirements other than the need for deep, persistent spring snow cover (April 15 to May 14) is the best predictor of wolverine occurrence. Wolverine year-round habitat use takes place nearly entirely within the area defined by deep persistent spring snow (Copeland et al. 2010). No records exist of wolverines denning anywhere but in snow, despite the wide availability of snow-free denning habitat within its range. A very small portion (~25%) of the Sagehen Basin has deep persistent snowpack during the spring. Where there is late persistent snow, it is in the upper elevations in the western-most and southern edge of the Basin. Habitat was modeled by Copeland et al. (2009) based on the number of years an area had deep persistent snow into the spring ranging from 1 year to 7 years. The modeled habitat was obtained from Jeff Copeland and used to assess the amount of suitable habitat for the Sagehen Project area. When the modeled wolverine habitat of deep persistent snow coverage is overlayed with the Sagehen Project area, the majority of the suitable wolverine habitat is ranked as low quality where deep snow persisted into the spring for only for 1 to 2 years. A small portion of the area, at the very far edge of the Basin ranked as moderate quality where deep snowpack persisted into the spring for 3 to 5 years. The majority of the Basin and proposed treatment units lie outside of the area with deep persistent snow. Only unit 213 falls within the area that has deep persistent snow, but only for 1 or 2 years, with 7 years being the highest quality habitat. Therefore, the majority of Sagehen Basin is either not suitable to wolverine (for denning) or is marginal at best at the western-most portion of the Basin.

However, it has been suggested that improving habitat for early and mid-seral species, such as deer, may benefit wolverine by improving prey habitat. Therefore, forest thinning activities that enhance forage for deer is likely to improve habitat conditions for wolverine. Alternative 1 would likely benefit wolverine the most compared to Alternative 3, followed by Alternative 2. Alternative 2 would not improve early or mid-seral forest habitat or increase the abundance and distribution of species dependent upon early and mid-seral habitats, such as deer.

Cumulative Effects:

Present, and reasonably foreseeable actions as displayed in Table 10 would not likely add measureable effects to past cumulative effects, since habitat modification, including forest thinning and fuels reduction projects do not appear affect the distribution of the species, since wolverine have large home ranges and inhabit a broad array of habitat types. Furthermore, there is no scientific evidence that land management activities, including forest management and prescribed burning would affect the abundance or distribution of the species (USDI Fish and Wildlife Service 2013). The Sagehen Project, as proposed, would not add to existing cumulative effects, except for an extremely, low potential to directly disturb the wolverine during project activities. However, since the proposed Sagehen Project activities encompass less than 2 percent of the wolverine's home range, the likelihood of this occurring would be unexpected. The proposed treatments of the action alternatives would not likely add to existing cumulative effects, since forest management is not likely to adversely affect the wolverine.

C. California Wolverine: Conclusion and Determination

It is my determination that implementation of Alternatives 1 and 3 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the California wolverine within the planning area of Tahoe National Forest. In the absence of a range wide viability assessment, this viability determination is based on local knowledge of the California wolverine as discussed previously in this evaluation, and professional judgment. The USDI Fish and Wildlife Service, in their proposed rule to list the wolverine as threatened, state that while land management activities, such as timber harvest, wildland firefighting, prescribed fire, and silvicultural practices can modify wolverine habitat, the wolverine is a habitat generalist and appears to be little affected by changes to the vegetative characteristics. Most wolverines occur at high elevations with rugged terrain that is not conducive to intensive forest management. The Service further states that habitat modifications resulting from the types of treatments proposed for the Sagehen Project would not significantly affect the conservation of the species.

D. Endangered Species Act Obligations

Section 7(a) of the Endangered Species Act requires agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and respect to its critical habitat, if any is designated. Section 49(a)(4) of the Act requires Federal agencies to confer with the Service on any action that is likely to jeopardize the continued existence of a species proposed for listing or result in the destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat.

At this time, the USFWS has not proposed designation of critical habitat. Designation of critical habitat will likely include physical and biological features essential to the wolverine, including areas defined by persistent spring snowpack and areas with avalanche debris and talus slopes or boulder fields in which females can construct dens.

<u>17.40 Special rules</u> – The USFWS is proposing a special rule that covers the North American wolverine in the contiguous United States.

- Any activity where wolverines are attempted to be, or are intended to be, trapped, hunted, shot, captures, or collected, in the continguous U.S., will be prohibited. It will also be prohibited to incidentally trap, hunt, capture, pursue, or collect wolverines in the course of otherwise legal activities. *The Sagehen Project, as proposed, would not trap, hunt, capture, pursue, or collect wolverines.*

- Incidental take of wolverine will not be a violation of Section 9 of the Act, if it occurs from any otherwise legal activities involving wolverines and their habitat that are conducted in accordance with applicable State, Federal, tribal, and local laws and regulations. Such activities occurring in wolverine habitat include:
    - Dispersed recreation such as snowmobiling, skiing, backpacking, and hunting for other species;
    - Management activities by Federal agencies and private landowners such as timber harvest, wildland firefighting, prescribed fire, and silviculture;
    - Transportation corridor and urban development;
    - Mining;
    - Transportation and trade of legally possessed wolverine skins and skins from captive-bred wolverines within the United States.

  Based on this information, the Sagehen Project is consistent with the Section 9 of the Act, and therefore conferencing is not required, since the proposed action alternatives would not likely jeopardize the continued existence of a species proposed for listing or result in the destruction or adverse modification of proposed critical habitat.

PALLID BAT

Status: USFS R5 Sensitive

A. Pallid Bat: Existing Environment

The pallid bat is a California Species of Special Concern and is listed as Sensitive on the Region 5 Forester's Sensitive Species List (USDA Forest Service 1998). The Tahoe National Forest LRMP, as amended, does not provide specific management for this species. However, the SNFPA ROD (January 2004) Standards and Guidelines should apply in locations where existing hardwood ecosystems are outside the natural range of variability.

Throughout California the pallid bat is usually found in low to middle elevation habitats below 6000 ft. (Philpott 1997), however, the species has been found up to 10,000 ft. in the Sierra Nevada (Sherwin pers. comm. 1998). Populations have declined in California within desert areas, in areas of urban expansion, and where oak woodlands have been lost (Brown 1996).

A variety of habitats are used, including grasslands, shrublands, woodlands, and coniferous forests (Philpott 1997). Pallid bats are most common in open, dry habitats that contain rocky areas for roosting. They are a yearlong resident in most of their range and hibernate in winter near their summer roost (Zeiner et al.1990). Occasional forays may be made in winter for food and water (Philpott 1997).

Day roosts may vary but are commonly found in rock crevices, tree hollows, mines, caves and a variety of human-made structures. Tree roosting has been documented in large conifer snags, inside basal hollows of redwoods and giant sequoias, and bole cavities in oaks (pers. comm. Sherwin 1998). Cavities in broken branches of black oak are very important, and there is a strong association with black oak for roosting (pers. comm. Pierson 1996). Roosting sites are usually selected near the entrance to the roost in twilight rather than total darkness. The site must protect bats from high temperatures, as this species is intolerant of roosts in excess of 104 degrees Fahrenheit. Pallid bats are also very sensitive to roost site disturbance (Zeiner et al. 1990, Philpott 1997).

Night roosts are usually more open sites and may include open buildings, porches, mines, caves, and under bridges (Philpott 1997, pers. comm. Sherwin 1998, Pierson 1996).

Pallid bats are a gregarious species, often roosting in colonies of 20 to several hundred individuals. Pregnant females gather in summer maternity colonies of up to several hundred females, but generally fewer than 100 (Brown 1996). Parturition occurs between May and July. Young are weaned in mid to late August with maternity bands disbanding between August and October (Pers. comm. Sherwin 1998).

The pallid bat is very maneuverable on the ground and commonly feeds on large ground-dwelling arthropods. Common prey species are Jerusalem crickets, longhorn beetles, and scorpions, both they will also forage at low heights of 0.5 to 2.5 meters above the ground on large moths and grasshoppers (Zeiner et al. 1990, Philpott 1997).

Potential risk factors (SNFPA 2001) that may apply to pallid bat include potential effects to prey species and roosting habitat:

- Reduction of hardwoods may reduce foraging habitat for pallid bats.
- Hardwood and hardwood conifer stands with thick understory vegetation between ground level and eight feet may provide limited flight opportunities.
- Dense and contiguous mature brush stands are not easily penetrated by bats.
- Heavy grazing may also affect prey species hiding and foraging habitat through the reduction of grasses and herbaceous vegetation.
- Due to their high sensitivity to human disturbance, pallid bats can be affected by mine exploration or closures, recreational caving, and reduction of tree roosts.
- If a variety of roosting sites are not available in a given area, loss of each individual roost site can have a negative effect in the local population.
- If bats are restricted to fewer roost sites, colonies may become larger, which would make them more susceptible to a single human disturbance. This could cause detrimental affects to maternity colonies or hibernating groups.
- Urban expansion and private harvest of hardwoods may remove large amounts of foraging habitat.
- Renewed mining on private lands may cause abandonment of roost sites.
- Insecticide use could potentially reduce the prey base for pallid bats. The direct effects of insecticides on bats are unknown.

In 1999, Dr. Joe Szewczak, bat researcher from the White Mountain Research Station, initiated a bat monitoring program in the Carman Valley Watershed Restoration area at Knutson Meadow to monitor changes in bat diversity in relation to restoration activities. Pallid bats were detected at Carman Valley on the Sierraville Ranger District through these monitoring efforts.

The pallid bat is usually found in low to middle elevation habitats below 6000 ft. Since the Sagehen Project is located at elevations above 6,000 ft. the Sagehen Project is outside the known range of the species. Although individuals have been found at elevations up to 10,000 ft, it is not expected that this is a common occurrence. Therefore, this project will have no effect on the pallid bat and will not be analyzed in detail.

It is my determination that implementation of Alternatives 1 and 3 will not affect the pallid bat, since the Sagehen Project is outside the known range of the species.

TOWNSEND'S BIG-EARED BAT

Status: USFS R5 Sensitive

A. Townsend's Big-Eared Bat: Existing Environment

The Townsend's big-eared bat is a USFWS Species of Concern, a California Species of Special Concern, and is listed as Sensitive on the Region 5 Forester's Sensitive Species List (UDSA Forest Service 1998). The Tahoe National Forest LRMP, as amended, does not provide specific management guidelines for this species. However, general guidelines for riparian areas (listed above), old forests (listed above) and mining should provide for the habitat needs of this species. Mining standards and guidelines are listed in the Tahoe National Forest LRMP, as amended.

The Townsend's big-eared bat occurs throughout the west and is distributed from the southern portion of British Columbia south along the Pacific Coast to central Mexico and east into the Great Plains, with isolated populations occurring in the south and southeastern United States (Sherwin 1998).

In California, the species is typically found in low desert to mid-elevation montane habitats, although sightings have been reported up to 10,800 feet (Philpott 1997, Sherwin 1998). Habitat associations include desert, native prairies, coniferous forests, mid-elevation mixed conifer, mixed hardwood-conifer forests, riparian communities, active agricultural areas and coastal habitat types (Kunz and Martin 1982, Brown 1996, Sherwin 1998). The Mother Lode within the Sierra Nevada foothills has been known historically as the "heart of concentrations" (Pierson 1996). Distribution of this species is strongly correlated with the availability of caves and cave-like roosting habitat (Sherwin 1998). Populations have incurred serious declines over the past 40 years in parts of California (Brown 1996).

Townsend's are a year-round California resident. Individuals are very loyal to their natal sites and usually do not move more than 10 kilometers from a roost site (Pierson et al. 1991, Pierson 1996). They roost within caves, abandoned mines, and buildings. Buildings must offer cave-like spaces in order to be suitable. This species is highly sensitive to roost disturbance (Brown 1996). Night roosts may occur in more open settings, including under bridges (Philpott 1997).

Historically, maternal colonies may have contained several hundred individuals. However, maternal colonies at the present usually contain from 35 to 150 individuals (Brown 1996). Maternal colonies select warm parts of the structure, and usually roost in the zone (Kunz and Martin 1982). These colonies form between March and June, but may vary by local climate conditions. Single pups are born between May and July (Sherwin 1998). Pups are fully weaned by six weeks (Kunz and Martin 1982). Females usually remain alert and active in maternity roosts. Clusters of females hang on open surfaces, making them readily detectable.

Males remain solitary during the summer. Winter hibernating colonies are composed of mixed-sexed groups and may range from a single individual to several hundred animals (Sherwin 1998). This bat hibernates throughout its range in caves and mines where temperatures are 55 degrees Fahrenheit or less, but generally above freezing. Roost sites are usually in the cooler air near the cave or mine entrance (Barbour and Davis 1969, Kunz and Marten 1982). Individuals may move during winter in response to temperature change (Barbour and Davis 1969).

Foraging usually begins well after dark (Kunz and Marten 1982). Foraging associations include edge habitats along streams and areas adjacent to and within a variety of wooded habitats (Sherwin 1998). In California, the species is shown to forage preferentially in association with native vegetation (Brown 1996). Flight is slow and maneuverable, with the species capable of hovering (Zeiner et al. 1990) and gleaning insects off foliage (Brown 1996). The Townsend's bat is a moth specialist, with over 90% of its diet composed of lepidopterans (Sherwin 1998).

Identification and protection of significant roost sites is still needed in most areas, and significant populations need to be monitored over time (Sherwin 1998).

In Tahoe National Forest, a documented maternal colony of Townsend's big-eared bats occurs on the Downieville Ranger District near the town of Sierra City.

Townsend’s big-eared bats were observed by Dr. Joe Szewczak (White Mountain Research Station) between 1999 and 2001 at Knutson Meadows on the Sierraville Ranger District as part of study monitoring bat diversity in the Carman Valley Restoration area.

Potential risk factors are primarily associated with the specific environment required for roost sites, and include:

- Loss or deterioration of caves and mines suitable for roosting
- Increased recreation caving may cause disturbance.
- Mine closures – time of year, loss of potential habitat
- Caustic chemicals, such as cyanide, used in ore extraction
- Waste ponds containing chemicals pose a risk to wildlife

Loss of riparian habitat for foraging may be locally important in some areas, but Townsend’s big-eared bat seems to be an opportunistic feeder capable of foraging in a variety of open habitats.

B. Townsend’s Big-Eared Bat: Effects of the Proposed Action and Alternatives including Project Design Standards

The Sagehen Project does not have any maternal roosting sites or potential maternal roost sites in the project area, Therefore, the action alternatives would not directly, indirectly, or cumulatively affect the Townsend big-eared bat.

C. Townsend’s Big-Eared Bat: Conclusion and Determination

It is my determination that implementation of Alternatives 1 and 3 will not affect the Townsend’s big-eared bat, since no suitable maternal roost sites occur in the project area.

WESTERN RED BAT

Status: USFS R5 Sensitive

A. Western Red Bat: Existing Environment

The western red bat is a California Species of Special Concern and is listed as Sensitive on the Region 5 Forester's Sensitive Species List (USDA Forest Service 1998). The Tahoe National Forest LRMP, as amended, does not provide specific management guidelines for this species. However, general guidelines listed above for riparian areas, forested stands, mining and hardwoods should provide for the habitat needs of this species.

The western red bat occurs throughout California in elevations up to 3000 feet and excluding desert habitat (pers. comm. Tatum 1998). However, Western red bats were observed by Dr. Joe Szewczak (White Mountain Research Station) on the Sierraville Ranger District between 1999 and 2001 as part of a monitoring effort for the Carman Valley Watershed Restoration Project. This observation represents an elevation range extension. Populations are scattered and considered rare throughout the state (Philpott 1997). The species is found primarily in riparian and wooded habitats, particularly in willows, cottonwoods, and sycamores (Bolster 1998).

Red bats are highly migratory between their summer and winter range, although migratory patterns are not well documented, and winter behavior is poorly understood. However, it is known to winter in the San Francisco area and to the south, and has been observed hibernating in leaf litter (Brown 1996). The timing of migration for males and females seem to differ, although groups tend to migrate together (Bolster 1998).

Western red bats are typically solitary. Roosting has been observed in caves, but generally these bats roost singly within tree foliage or shrubs, and often along edge habitat adjacent to streams or open fields. Colonies are not formed. Roost sites are generally hidden from view from all directions except from below. The lack of obstruction from below allows the bat to drop downward for flight. Roost sites usually have dark ground cover to minimize solar reflection, have nearby vegetation to reduce wind and dust, and are generally located on the south or southwest side of a tree (Bolster 1998).

Females give birth to one to five young per year with an average of 2.3. Young are born during June (Brown 1996, Bolster 1998).

Foraging is generally at high altitudes over the tree canopy and begins one to two hours after sunset. Red bats are solitary roosters, although they forage in close association with one another in summer. Food items consist of a wide variety of flying insects including homopterans, coleopterans, hymenopterans, dipterans, and lepidopterans (Bolster 1998), and are apparently based on size rather than type (Brown 1996).

There are many gaps in the knowledge of this species, and more information is required on roosting requirements, altitudinal distribution, migration patterns, effects of controlled burns, and effects of pesticide use (Bolster 1998).

Potential risk factors for the western red bat primarily focus on specialized roosting habitat needs that require riparian hardwood vegetation.

- Reduction of tree roosts due to past harvest practices and reduction of hardwoods in riparian areas due to severe competition.

- Urban expansion, reservoir construction, private harvest of hardwoods and riparian vegetation may remove roosting habitat.

Potential risk factors associated with foraging requirements include:

- Woodland and conifer stands that contain thick understory vegetation could prevent foraging.
- Heavy grazing may also affect prey species hiding and foraging habitat through the reduction of grasses and herbaceous vegetation.
- Insecticide use could potentially reduce the prey base for red bats.

B. Western Red Bat: Effects of the Proposed Action and Alternatives including Project Design Standards

The western red bat occurs throughout California in elevations up to 3000 feet. The Sagehen Project is located above 3,000 feet. Therefore, this project is above the elevational range where this species is known to occur, and no direct, indirect, or cumulative effects to this species are expected to occur from the action alternatives.

It is my determination that implementation of Alternatives 1 and 3 will not affect the western red bat.

IX. LITERATURE CITED AND REFERENCES

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Appendix A. Sagehen Fragstats Analysis

Becky Estes, Central Sierra Province Ecologist, Eldorado National Forest, Placerville, CA
April 18, 2013

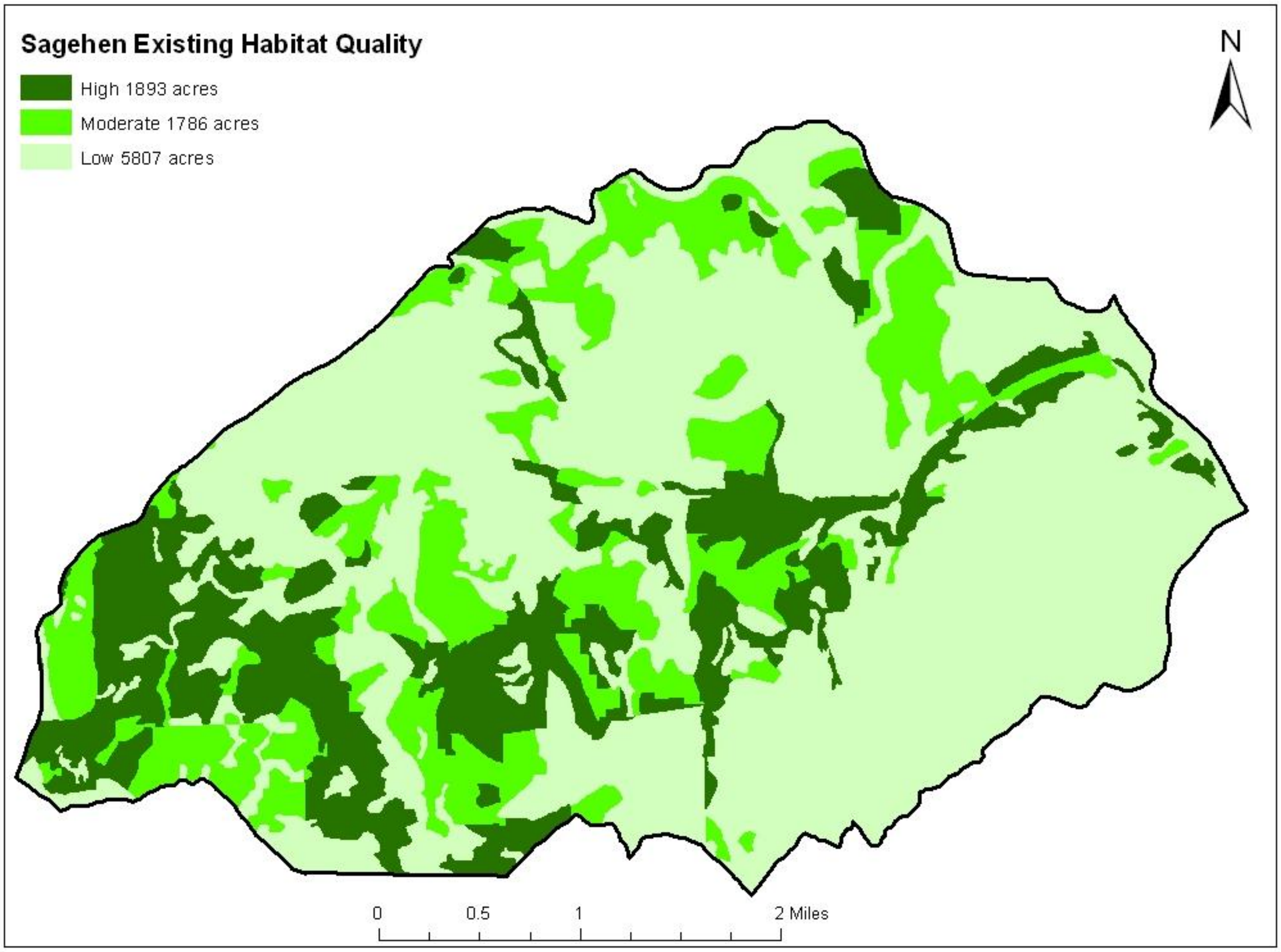


Figure 1. Existing marten habitat as classified by high, moderate, and low quality types.

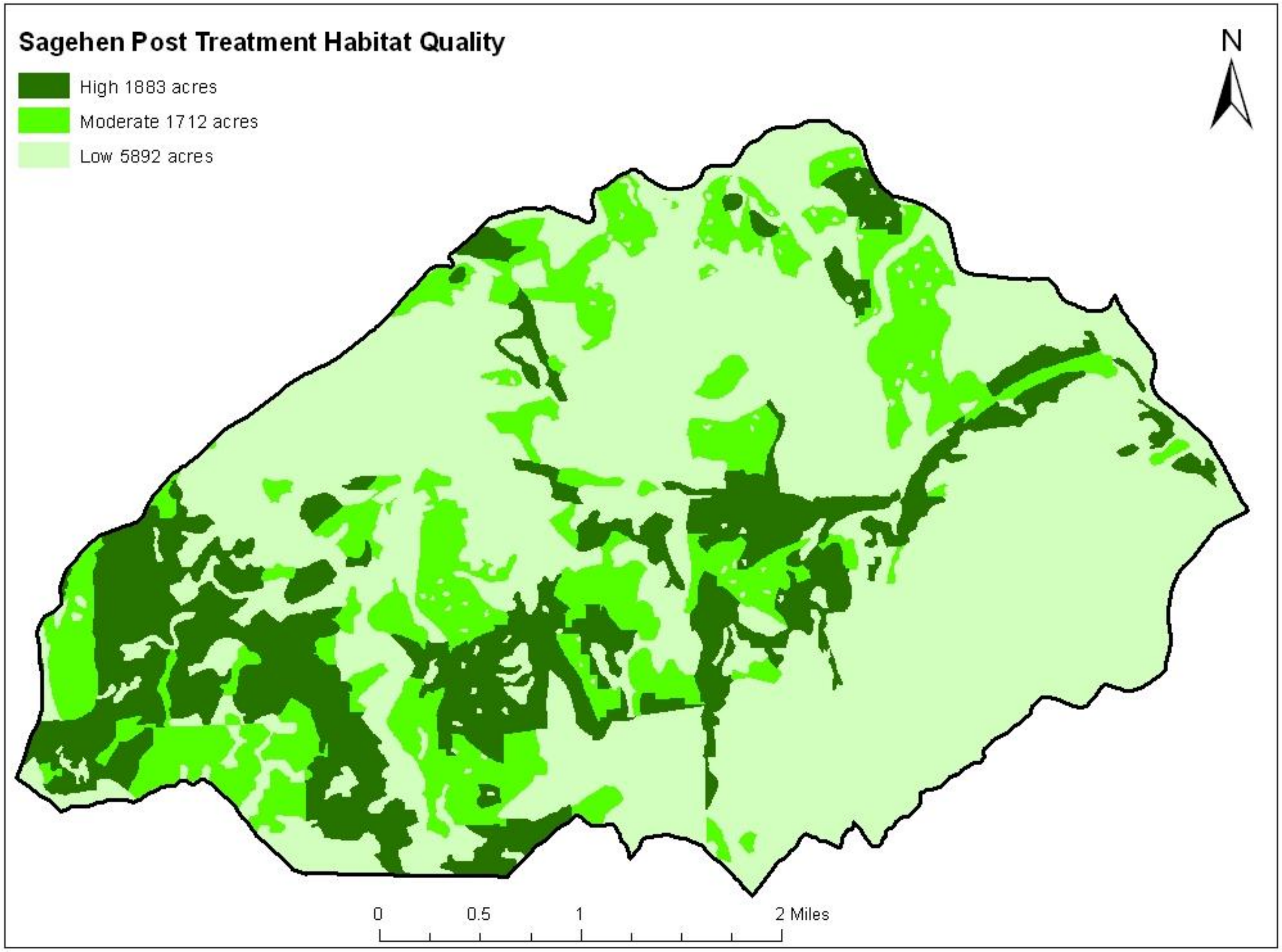


Figure 2. Post treatment marten habitat as classified by high, moderate, and low quality types.

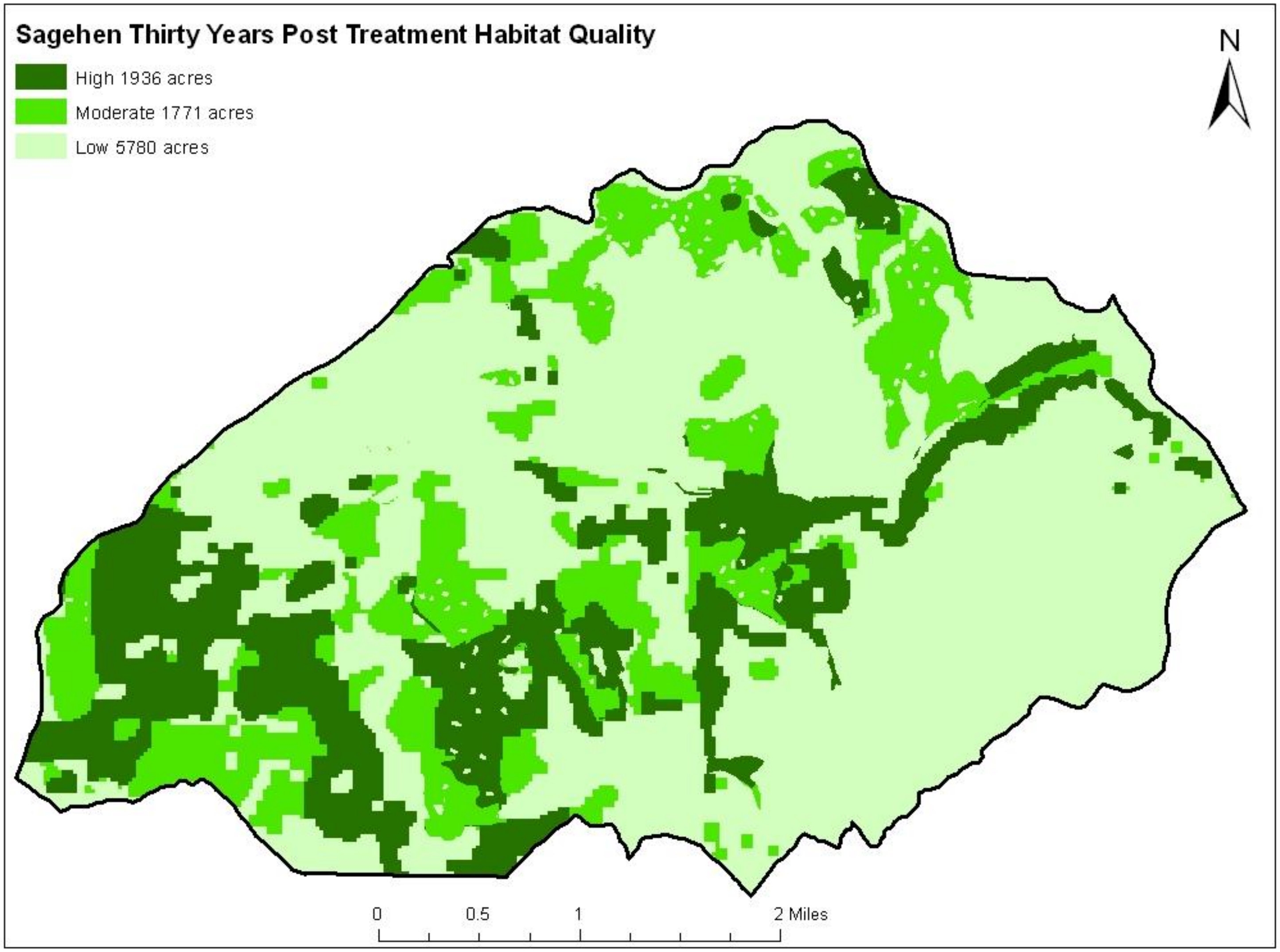
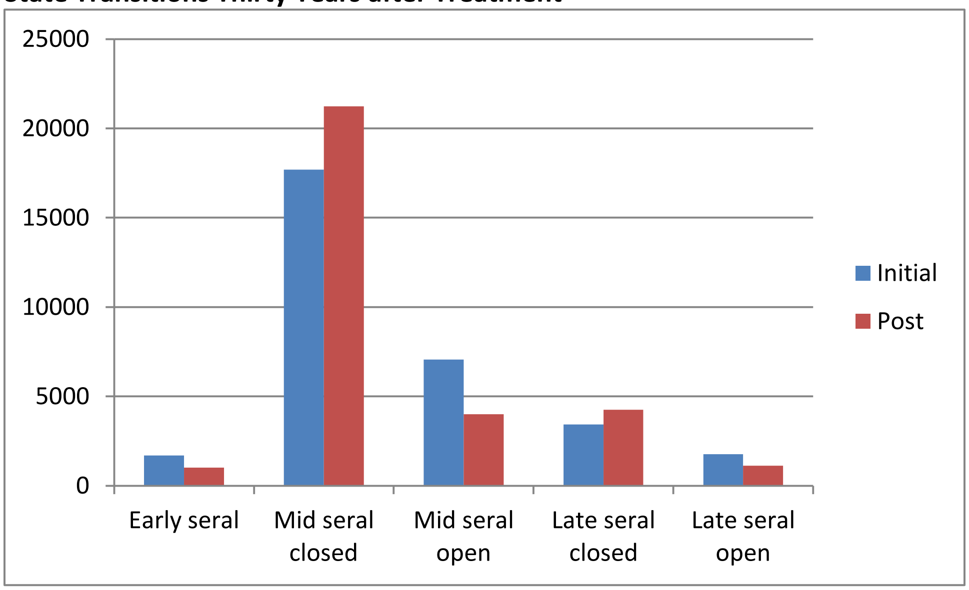


Figure 3. Thirty year post treatment marten habitat as classified by high, moderate, and low quality type

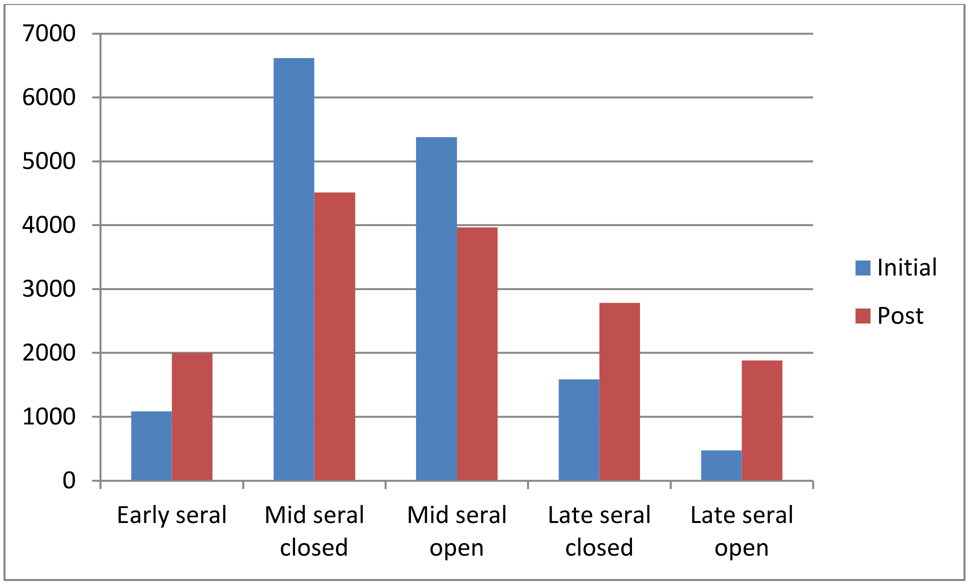
Thirty Year Out Model Simulation Methodology

No spatial models exist that allow us to predict how the landscape will transition in thirty years. In order to assess the changes, VDDT (Vegetation Dynamics Development Tool) was utilized. The landscape was partitioned into successional states (early seral, mid seral open, mid seral closed, late seral open, and late seral closed) by appropriate vegetation types (based on CWHR). Using the Landfire BpS models the proportion of the landscape was determined for each vegetation type/successional state and run through a simulation model for 30 years (see figures below). Some assumptions that were made are as follows: no stand replacing events were modeled as we assumed no events would occur that would set late seral back to early seral with the exception of the treatments. The 30 year simulated proportions were then randomly assigned to pixels within each vegetation type/successional state. The resulting habitat was then classified into high, moderate or low marten quality using the techniques adopted for the project. The units were projected thirty years based on FVS simulations and were burned into the final layer before spatial analysis was conducted.

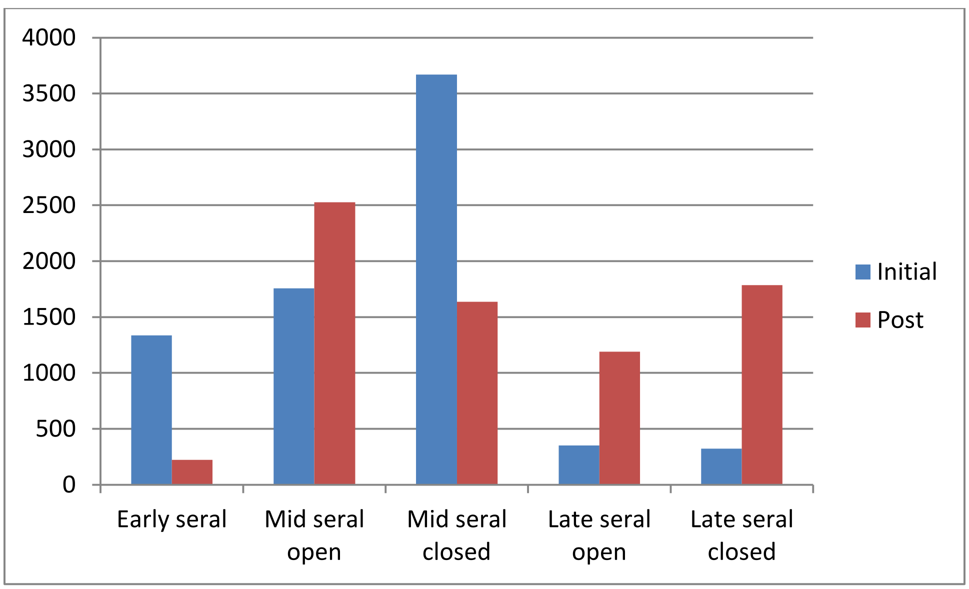
State Transitions Thirty Years after Treatment



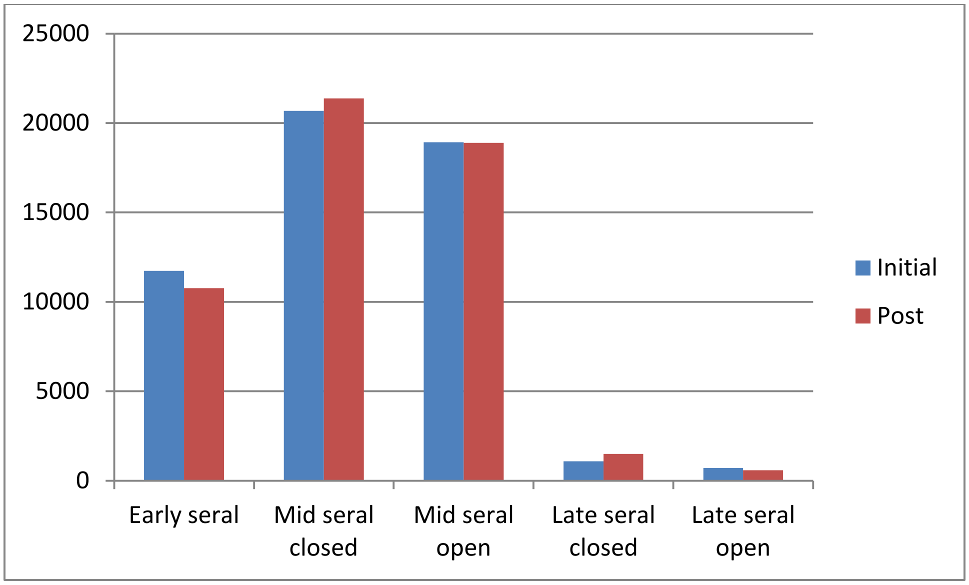
Sierran Mixed Conifer/White Fir BpS model 280



Red Fir BpS Model 320



Subalpine/Lodgepole BpS Model 520



Eastside Pine BpS Model 310

Table 1. Estimated amount and configuration of high-quality American marten (*Martes americana*) habitat in existing vegetation and immediate post and thirty years after treatment at Sagehen Experimental Forest, California.

Variable name	Existing	Post treatment	30 years post treatment
Percentage of landscape (PLAND)	20.0	19.9	20.4
Number of patches (NP)	29	28	41.0
Largest patch index (LPI)	8.1294	8.1294	8.0808
Percent cover of core areas (CPLAND)	4.1256	3.4435	4.9335
Number of distinct core areas (NDCA)	34	38	29
Mean patch area (AREA_MN), ha	26.4 (65.1)	27.3 (65.9)	19.2 (54.5)
Area weighted core area (CORE_AM), ha	47.5 (17.4)	43.8 (16.9)	60.2 (20.7)
Area weighted gyration (GYRATE_AM)	698.6 (221.8)	700.3 (223.6)	664.0 (201.4)
Mean nearest neighbor distance (ENN)	128.7 (63.6)	139.1(69.4)	126.0 (63.2)
Proximity Index (PROX)	51.7 (126.8)	52.5 (128.3)	55.2 (106.7)
Connectedness index	1.9704	1.8519	1.7073

[1]Search radius is set for 100 meters.
[2]Threshold distance for Connectedness index is set for 100 meters.
[3]Edge depth is set for 100 meters.

Summary

- High quality habitat only decreased by 0.1% across the landscape immediately post-treatment. The number of patches decreased initially post treatment from 29 to 28 patches. Thirty years after treatments high quality habitat was predicted to increase patches.
- The mean patch area was 26.4 hectares in existing conditions and is projected to increase slightly to 27.3 hectares immediate post treatment. The largest patch index did not change indicating that the largest patches remained intact immediately post treatment. Eight percent of the landscape remains dominated by large high quality patches. Thirty years after treatment the mean patch area decreases which correlates well with the number of patch increase. These additional patches were likely small patches of mid seral that transitioned into late seral that may remain isolated.
- Percentage of core area (see definition below) decreased initially after treatment and was predicted to increase 30 years post treatment. The number of core area also increased indicating that more potential core area habitat has been created but it was only slightly higher. Treatments may decrease the edge effect. Thirty years post treatment the number of core areas has decreased most likely a result on the increase in small high quality areas that remain isolated and unrelated to treatments rather attributed to stochastic events such as low intensity fire or insect mortality.
- Core area weighted by the size of the patches decreased slightly after treatment and then was predicted to increase thirty years after treatment. The edge effect is likely to decrease allowing more core habitat with high quality patches.
- The average distance an organism (radius of gyration) can move across the landscape before encountering another patch increased slightly after treatment as did the distance to the nearest patch however the dispersion of the high quality patches changed very little. After thirty years,

the distance an organism could travel decreased below what was observed in existing conditions. In addition, the distance to nearest neighbor also decreased.

- The proximity and connectedness index showed that immediately after treatment and predicted thirty year habitat quality was less fragmented and isolated than what was observed in the existing conditions.

Definitions

Percentage of landscape (PLAND) quantifies the proportional abundance of each patch type in the landscape. Like total class area, it is a measure of landscape composition important in many ecological applications. However, because PLAND is a relative measure, it may be a more appropriate measure of landscape composition than class area for comparing among landscapes of varying sizes.

Number of patches (NP) of a particular patch type is a simple measure of the extent of subdivision or fragmentation of the patch type. Although the number of patches in a class may be fundamentally important to a number of ecological processes, often it has limited interpretive value by itself because it conveys no information about area, distribution, or density of patches. Of course, if total landscape area and class area are held constant, then number of patches conveys the same information as patch density or mean patch size and may be a useful index to interpret. Number of patches is probably most valuable, however, as the basis for computing other, more interpretable, metrics. Note that the choice of the 4-neighbor or 8-neighbor rule for delineating patches will have an impact on this metric.

Largest patch index (LPI) at the class level quantifies the percentage of total landscape area comprised by the largest patch. As such, it is a simple measure of dominance.

Core area percentage of landscape (CPLAND) is defined the same as core area (CORE) at the patch level (see Core Area), but here core area is aggregated (summed) over all patches of the corresponding patch type and computed as a percentage of the total landscape area, which facilitates comparison among landscape of varying size.

Number of disjunct core areas (NDCA) is defined the same at the patch level (see Number of Core Areas), but here it is aggregated (summed) over all patches of the corresponding patch type. Number of disjunct core areas is an alternative to the number of patches when it makes sense to treat the core areas as functionally distinct patches.

Mean patch area (AREA_MN), ha is the average patch area by class type with the standard deviation.

Core area is defined as the area within a patch beyond some specified depth-of-edge influence (i.e., edge distance) or buffer width. Like patch shape, the primary significance of core area in determining the character and function of patches in a landscape appears to be related to the 'edge effect.' As discussed elsewhere (see Area and Edge Metrics), edge effects result from a combination of biotic and abiotic factors that alter environmental conditions along patch edges compared to patch interiors. The nature of the edge effect differs among organisms and ecological processes (Hansen and di Castri 1992). For example, some bird species are adversely affected by predation, competition, brood parasitism, and perhaps other factors along forest edges. Core area has been found to be a much better predictor of habitat quality than patch area for these forest interior specialists (Temple 1986). Unlike patch area, core area is affected by patch shape. Thus, while a patch may be large enough to support a given species, it still may not contain enough suitable core area to support the species.

Area weighted core area (CORE_AM), ha is the amount of area that is in core weighted by the size of the entire landscape.

Area weighted distinct core area (DCORE_AM), ha

Proximity mean index (PROX_MN) - the *proximity index* (PROX) was developed by Gustafson and Parker (1992)[see also Gustafson and Parker 1994, Gustafson et al. 1994, Whitcomb et al. 1981]. This index considers the size and proximity of all patches whose edges are within a specified search radius of the focal patch. The index is computed as the sum, over all patches of the corresponding patch type whose edges are within the search radius of the focal patch, of each patch size divided by the square of its distance from the focal patch. The proximity index quantifies the spatial context of a (habitat) patch in relation to its neighbors of the same class; specifically, the index distinguishes sparse distributions of small habitat patches from configurations where the habitat forms a complex cluster of larger patches. All other things being equal, a patch located in a neighborhood (defined by the search radius) containing more of the corresponding patch type than another patch will have a larger index value. Similarly, all other things being equal, a patch located in a neighborhood in which the corresponding patch type is distributed in larger, more contiguous, and/or closer patches than another patch will have a larger index value. Thus, the proximity index measures both the degree of patch isolation and the degree of fragmentation of the corresponding patch type within the specified neighborhood of the focal patch. The index is dimensionless (i.e., has no units) and therefore the absolute value of the index has little interpretive value; instead it is used as a comparative index.

Consider the *Proximity index* (PROX). The *Proximity index* operates at the patch level. For each patch, the size and distance to all neighboring patches of the same type (within some specified search distance) are enumerated to provide an index of patch isolation. A patch with lots of other large patches in close proximity will have a large index value (i.e., low isolation). Both the *Mean* and *Area-weighted mean proximity index* can be calculated at the class and landscape levels.

Area weighted gyration (GYRATE_AM) - However, patch size can also be characterized by its spatial extent; i.e., how far-reaching it is. This is known as the patch radius of gyration, which measures how far across the landscape a patch extends its reach on average, given by the mean distance between cells in a patch. The radius of gyration can be considered a measure of the average distance an organism can move within a patch before encountering the patch boundary from a random starting point. When summarized for the class or landscape as a whole using an area-weighted mean, this metric is also known as correlation length and gives the distance that one might expect to traverse the map while staying in a particular patch, from a random starting point and moving in a random direction (Keitt et al. 1997).

Mean nearest neighbor distance (ENN) - As conventionally computed, mean nearest neighbor distance is based on the distances between neighboring patches of the same class. *Euclidean nearest neighbor distance* (ENN) is perhaps the simplest measure of patch isolation. Here, nearest neighbor distance is defined using simple Euclidean geometry as the shortest straight-line distance between the focal patch and its nearest neighbor of the same class, based on the distance between the cell centers of the two closest cells from the respective patches. At the class and landscape levels, FRAGSTATS computes the mean in ENN (ENN_MN). At the class level, ENN_MN can only be computed if there are at least two patches of the corresponding type. At the landscape level, ENN_MN considers only patches that have neighbors. Thus, there could be 10 patches in the landscape, but eight of them might belong to separate patch types and therefore have no neighbor within the landscape. In this case, ENN_MN would be based on the distance between the two patches of the same type. These two patches could be close together or far apart. In either case, the mean nearest-neighbor distance for this landscape may not characterize the entire landscape very well. For this reason, these metrics should be interpreted carefully when landscapes contain rare patch types.

Connectedness index - The *connectance index* (CONNECT) as the proportion of functional joinings among all patches, where each pair of patches is either connected or not based on some criterion. FRAGSTATS computes connectance using a threshold distance specified by the user and reports it as a percentage of the maximum possible connectance given the number of patches. The threshold distance in FRAGSTATS is based on Euclidean distance, but it could be based on some other measure of functional distance, such as the least cost path distance.